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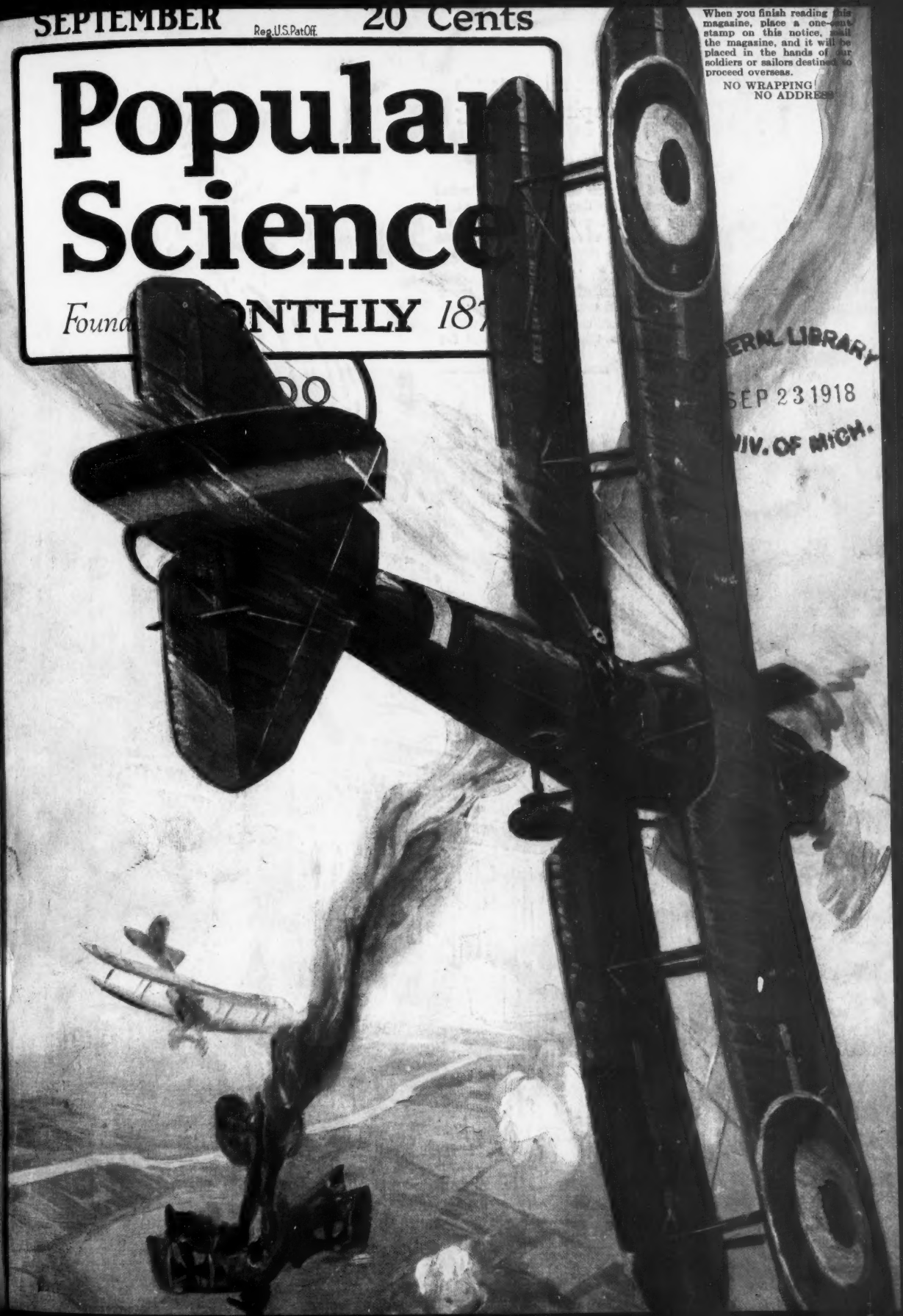

. . . and at all 6 stands
in the Capitol building

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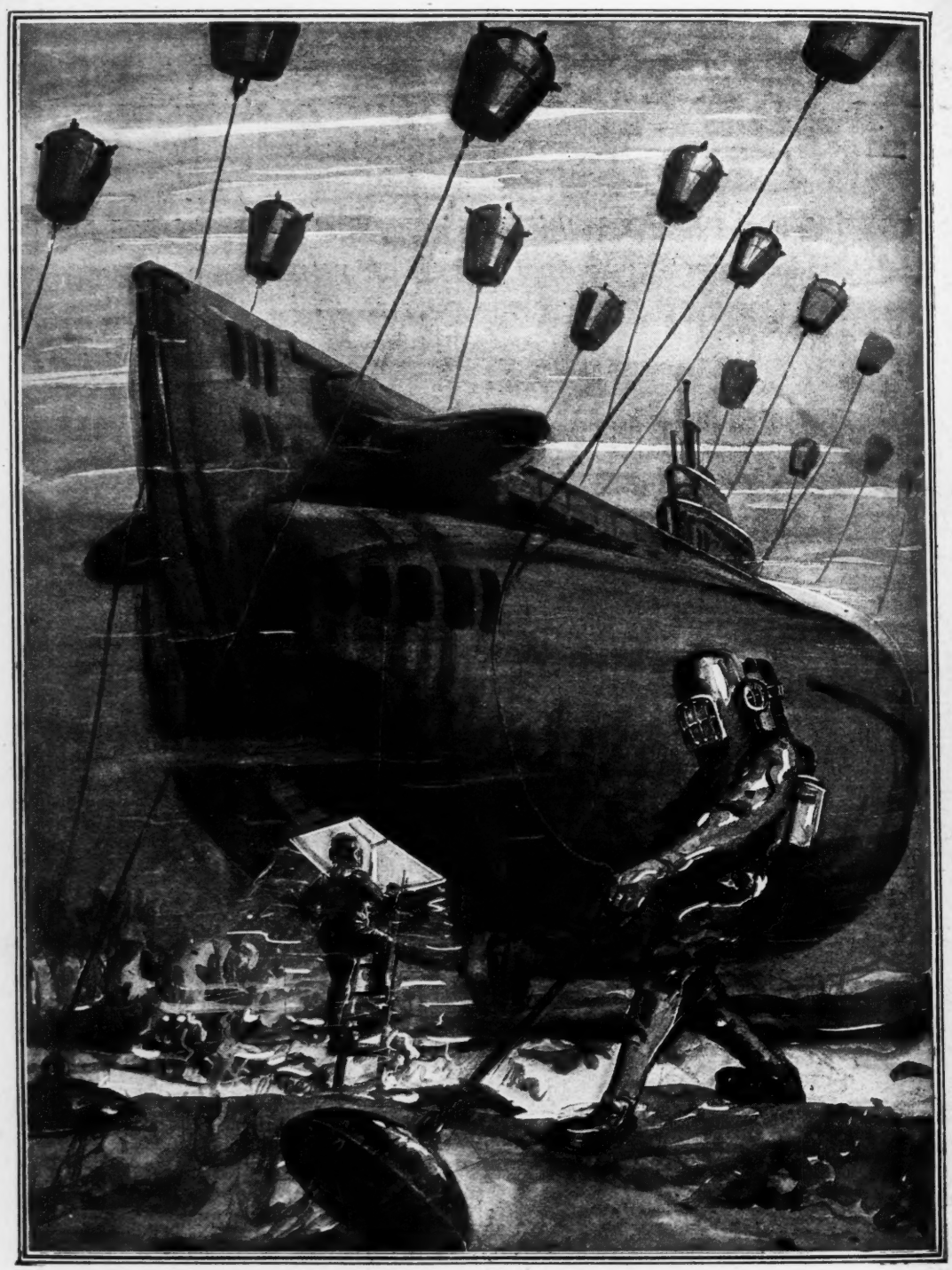
Order your copy of the October issue now from your newsdealer. The edition will be limited. Price, 20 cents on all news-stands.

Creeping Through a Mine Field in Safety



The divers are clearing away the mines. They leave and enter the submarine by a door, just as they would a house. What keeps the water out of the boat? Just air, but at such a pressure that it pushes the water back. Wheels enable the boat to roll on the ocean bed

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Now Comes the Sea Tank

Did the Italians blow up the Austrian dreadnought in Pola with an American wheeled submarine?

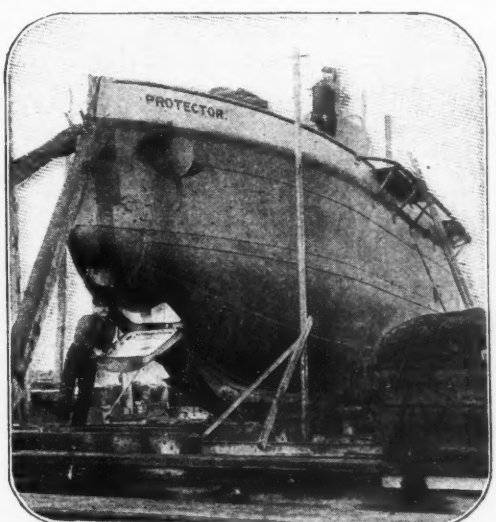
By Robert G. Skerrett

WHEN Lieutenant Commander Pellegrini forced his way into the harbor of Pola and sank at least one of Austria's biggest dreadnoughts, what sort of craft did he command? The dispatches say that he used a "sea tank," and that "the boat was forty feet long, six feet wide, and propelled by electricity. There is an endless rotary chain around the vessel fitted with barbs which cut nets and other obstacles, like the land tanks. The craft has two torpedo tubes."

These particulars may be correct, and, again, they may be nothing more than governmental camouflage to cover up the laxity at Pola, which permitted the Italians to get by the guardship at the harbor mouth, to thread a maze of cunningly-planted mines, and, finally, to break through an inner defense consisting of a barrier net of wire rope. But if Lieutenant Commander Pellegrini did use a so-called "sea tank," its success was spectacular, and the public, both lay and technical, is naturally curious to know what new order of torpedo-boat has been evolved for naval warfare.

A bit of hitherto unpublished history may help us to a fairly accurate idea of the real nature of the sea tank in question. As in the case of the land tank, we may find that the type is substantially a duplication of an American invention conceived primarily to facilitate commercial salvage operations under water. Pellegrini's sea tank was, in all likelihood, a modification of the wheeled submarine *Argonaut* built by Simon Lake in Baltimore in 1897.

The *Argonaut* was a stumpy cigar-shaped vessel of steel, thirty-six feet long, having a maximum diameter of nine feet. When fully submerged, her displacement was about fifty-nine tons. The boat was built to travel on the surface or to roll along on the oceanbed, and two big cog-rimmed driving wheels, driven by a gasoline motor through suitable gears, propelled her on the sea floor. By regulating the undersea craft's dead weight with water ballast the pressure or grip upon the bottom could be adjusted. The front compartment of the old *Argonaut* was a compressed air chamber or air lock that is used in tunneling beneath the rivers. The air in the chamber was compressed to such a degree that it

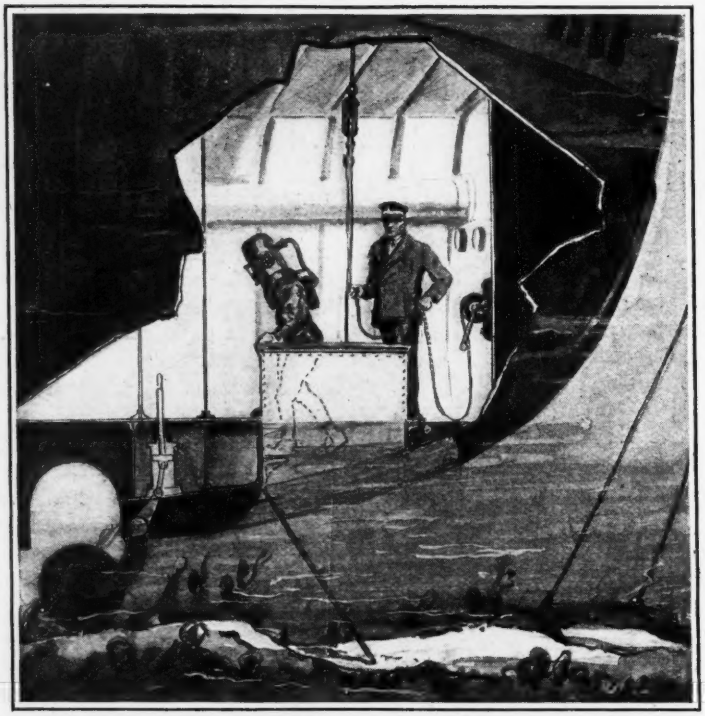


© R. G. Skerrett

This wheeled submarine of the Argonaut type was sold to Russia when at war with Japan

prevented the water from coming in through an open hatch while a diver could step from the chamber right out upon the bottom of the sea.

The purpose of the *Argonaut* was to make salvage operations safer and easier by furnishing the divers with a submerged base from which to work unhampered by weather conditions at the surface. The *Argonaut* cruised upon and below the waters of Chesapeake Bay in 1898 and also covered many hundred miles both under and above water. The following extract from the vessel's log, dated July 28 of that year, is very suggestive:



The air pressure on the inside prevents the water from entering the hold when the trap door on the bottom is opened for the diver

"We were desirous of making a search for the cables which connected with the mines guarding the entrance to the harbor at Hampton Roads, but could not obtain permission from the authorities, who were afraid we might accidentally sever them, which would, of course, make their entire system of defense useless."

However, Mr. Simon Lake had a cable laid upon the bottom at another point, and then approached it from a distance after taking his bearings by compass. The *Argonaut* rolled along with the door of the diving compartment open, and succeeded without any trouble whatever in hooking up the cable and bringing it into the chamber, where it was cut to complete the demonstration.

Early in 1906, Mr. Lake was in Europe, and went to Rome to interest the Italian Ministry of Marine in his naval submarines which he had developed after building the *Argonaut*. Mr. Lake laid much emphasis upon the distinctive features of his type embodied in the diving compartment and his improved form of bottom wheels. The Minister of Marine listened for a while and then suavely said to Mr. Lake:

"But, my dear sir, our shores dip too quickly and suddenly to great depths to make these wheels of value in defending our seacoasts."

Mr. Lake promptly rejoined: "Yes, that is quite true, Your Excellency, with the exception of the Adriatic seaboard which lies nearest to your likeliest foe, Austria. From Ancona northward and then eastward to the neighborhood of Pola the 120-foot depth line extends off shore anywhere from five miles to many times that distance, and that sandy sea-bed is just the area within which a submarine with bottom wheels could do its best work in protecting the Gulf of Venice from a hostile naval force."

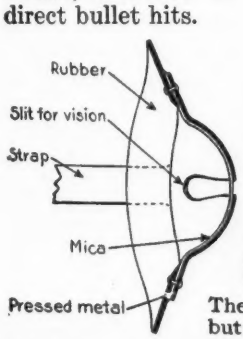
Can it be that the Italians borrowed Mr. Lake's suggestion? This ingenious American has shown more than once how a couple of his submarines could sweep mine fields with little fear of detection. Divers could cut nets easily without disturbing in the least the supporting surface buoys that might otherwise betray the presence of the attacking submarine.

How France Protects Her Soldiers' Eyes

FOUR-FIFTHS of the cases in which soldiers sustain serious injuries of their eyes can be avoided, according to the statistics collected by Professor Terrien, an eminent French eye specialist. Only in one out of every five cases the injury produced by bullets, shrapnel, or splinters of bombs or shells is of such nature that it could not have been prevented by any ordinary safeguard.

To protect the eyes of the soldiers against avoidable injuries Professor Terrien and Major M. E. Cousin devised goggles, of which more than 10,000 have been distributed among the French troops on the West front and used with satisfactory result. The goggles, which are pressed from a single plate of metal one millimeter in thickness (about 39/1000 of an inch), are shaped to cover both eyes. The lower rim rests upon the lower arch of the eye cavity, the upper edge fits against the brow, and the middle parts are shaped to conform to the convex curve of the eyeballs. The brim of the goggles is covered with rubber to make them fit tight enough to protect the eyes against tear-producing gases. Cuts in the form of crosses, somewhat wider at the ends of the arms than at the point of intersection, enable the wearer of the goggles to see, while at the same time his eyes are protected from shell splinters. For additional protection the cross-shaped slits are covered on the inside by plates of mica.

These eye-shields are not, of course, intended to withstand direct bullet hits.



These goggles do not shield the eyes against bullets, but they do prevent injuries from stray shell splinters

If you don't have an opportunity to go to the links and practise putting, try this device

Golfers! Here's a Way to Practise Putting Indoors

A PUTTING disk has been invented for practising golf indoors and also for playing a game, which consists in driving a golf ball into a trap with the least number of strokes. A ball struck with enough force to knock over or upset the disk does not count. When the ball is driven so that it is held in the disk, the shot counts. The ball can be removed by raising the disk. The putter and golf ball ordinarily employed on the links can be used. The disk (four and one-half inches in diameter) is collapsible, so that it can be carried in a box one-fourth of an inch in height.

A Magnet for Removing Metal Chips

A MAGNET taken out of an old house telephone can be used for removing metal chips made in drilling. If the magnet is too large to go into the hole it can be placed in contact with a small rod as an extension. Several magnets tied together will recover tools dropped down an open partition. Drop the magnets down by means of a string.

The "Harpitar," a Cross Between the Guitar and the Harp

"HOW can I improve the sound of the guitar?" asked Mr. R. E. Bates of Brooklyn, N. Y., speaking to himself of course, after the manner of inventors. Then he answered the question by thrumming the "harpitar," an instrument in which he has combined harp and guitar. Listen now to Mr. Bates' exposition of his invention:

"It combines the simple chromatic scale of the guitar with the peculiarly beautiful tones of the harp. When placed upon the lap the body of the instrument rests against the performer, the edge of the soundboard forming a rest for the wrist of the right hand so as to allow the hand freedom for attacking the strings.

Looks like a harp—strung like a guitar. No wonder its inventor calls it the "Harpitar"

"The present-day guitar is a sweet-toned instrument, but it lacks projecting power, an inherent defect due to its general structure and to the manner of securing the strings over the soundboard. The pressure of the strings is but a fraction of the string tension. In the harpitar the whole tension of the string is fully exerted upon the soundboard. Hence thicker strings can be used and hence a greater volume of tone secured. The harpitar has six strings, like the guitar; a harp, twenty-six in the smallest size. Hence the harpitar is a money-saving instrument. In the harp the strings are distributed over the entire length of the sound-board. Since the greatest volume of tone is obtained at the center, the strings nearer the ends emit less mellow notes. But there can be no difference in volume because the six strings are all located at the center. The sound-hole is placed at the back of the body. Indeed, the bottom of the body is entirely open so that the sound waves well forth freely."

Though not musical, still we can appreciate the economy of having a two-in-one instrument.

Bee Culture in Macedonia Is Primitive

MACEDONIA, one of the most turbulent sections in the Balkan states, from which many a cry has startled a suffering world, does not seem to have progressed a great deal in civilization since the days of the great Alexander. Life in Macedonia is conducted on the most primitive lines, and the same is true of agriculture, the various trades, commerce and the methods of transportation. Ox-carts are still in common use; and the beehives, which are never lacking even at the poorest farmhouse, are of the same primitive form that were in use two thousand and more years ago. The picture shows a row of these beehives, placed on a shelf along the outside wall of the farmhouse. Below them the firewood is stored.

The hives are made of bark, supported by a framework of twigs and covered with straw roofs.

Two thousand years ago they used beehives just like these in Greece. The beehives are built on a shelf

For the Man Who Goes Off and Forgets to Water the Geraniums

LEONARD I. LELIEVRE must have studied the kerosene lamp before he evolved the flower-pot for which the United States Government recently granted him a patent. If, he reasoned, oil can be soaked up by a wick and a lamp kept burning, why shouldn't a wick keep the earth in a flower-pot moist?

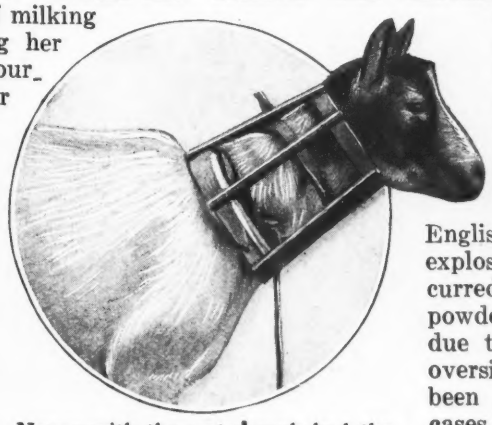
At all events, Lelievre embodied the wick idea in a flower-pot which commends itself at sight to the man who always forgets to water his geraniums. The flower-pot has a false bottom which is filled with water. A wick runs up from the false bottom to a pad of felt on which the earth rests. A metal disk on top of the felt pad prevents the roots of the plant from working their way down into the wick opening. It is needless to say the false bottoms must be kept full of water.

The plant waters itself by means of a saturated wick

Restricting Nanny's Milk Diet by Making Her Wear a "Choker"

THE goat in the accompanying picture does not affect the latest style of fashion in goat-collars. Neither does she wear the crate around her neck because of a sore throat or other ailment. Nanny has to wear this "choker" because she had acquired the habit of milking herself and thus robbing her young of the necessary nourishment. With this collar on, Nanny cannot reach the milk supply upon which her kids have a just and prior claim.

The collar consists of two or three rings connected by strips of wood. The lowest ring is wide enough to rest upon the shoulders and the top ring is tight to prevent its slipping over the head of the goat.



Nanny with the crated neck had the naughty habit of drinking her own milk

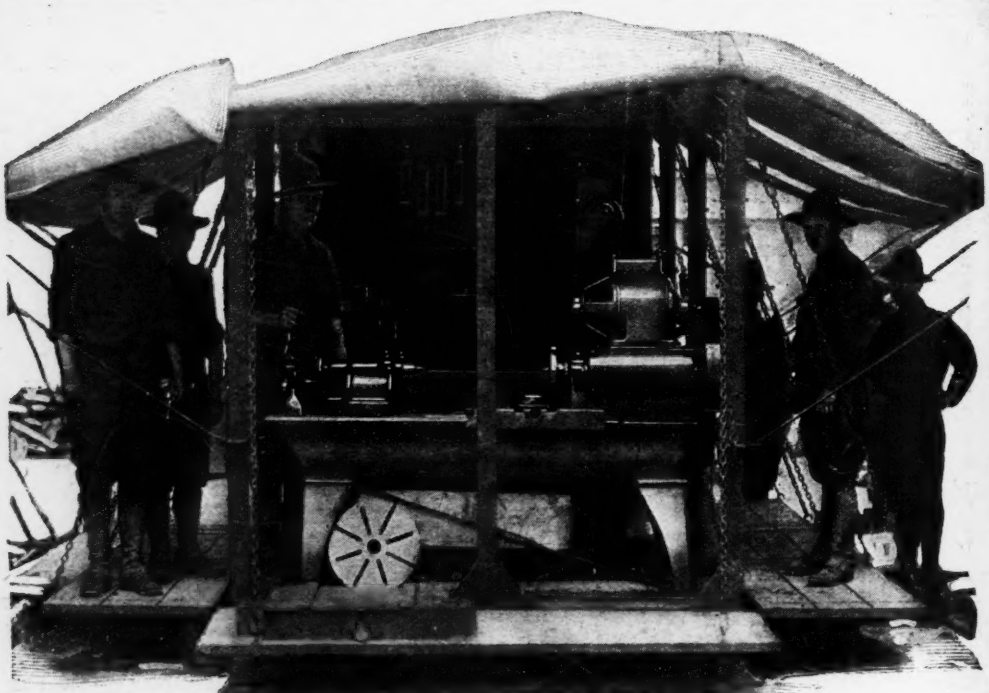
Manufacturing Explosives Can Be Made Safer than Railroading

DR. W. G. HUDSON, chairman of the Subcommittee on Industrial Diseases and Poisons, Council of National Defense, says that the automatic machinery which will replace human labor is of far more importance to the manufacture of explosives than the reduction of labor costs brought about by such substitution. Machinery of this kind is employed to a considerable extent by all large manufacturers of explosives in the Unites States, most of it having been invented by the employees themselves. Some of these machines, when operated by one or two men, accomplish as much as twenty or thirty workmen could do by older methods.

Dr. Hudson points out that the prime advantage of the machines is to reduce the number of employees in such hazardous work, thereby lessening the risk to human life. He says, however, that the popular conception of the peril involved in the manufacture of dynamite, smokeless powder, guncotton and trinitrotoluol is greatly exaggerated. If they were made by skilled chemists under the best of laboratory conditions, there would seldom be accidents, as "making explosives is a safer business than railroading." But it is difficult to guard against carelessness or negligence, many of the men being unskilled and having no speaking knowledge of English. Many of the explosions that have occurred in munition and powder factories were due to carelessness or oversight, though it has been proved in some cases that they were of enemy origin.

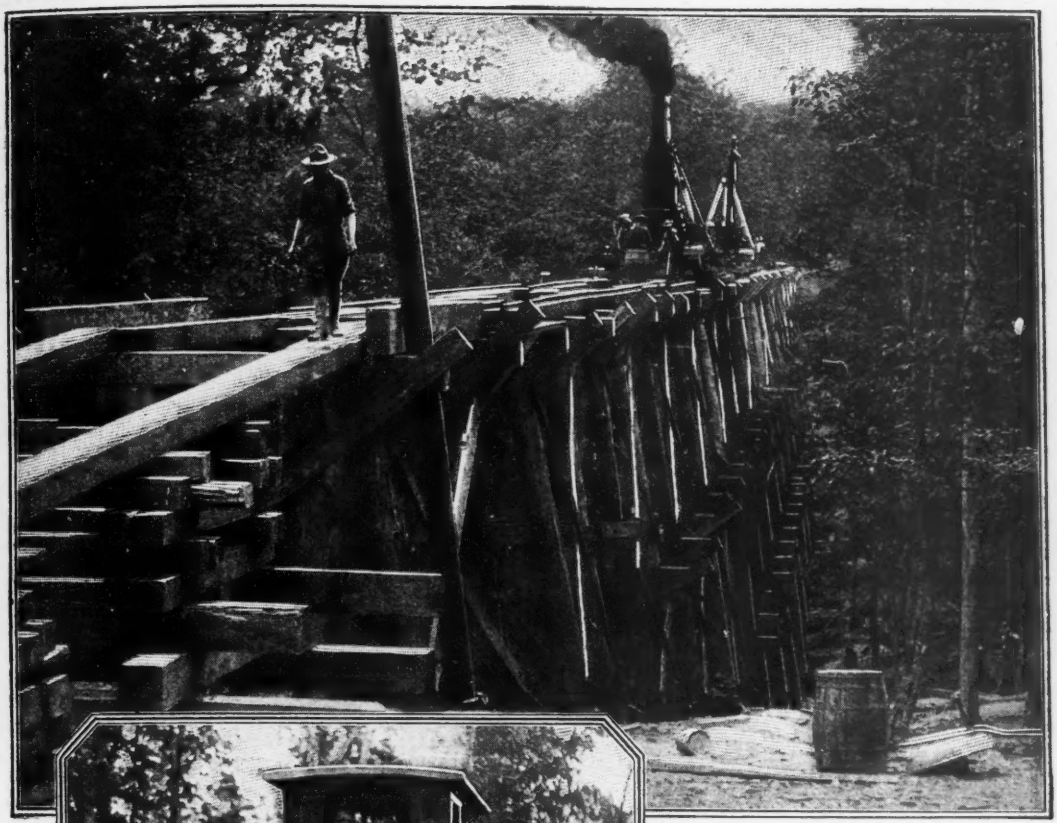
© Photos International Film Service

They build a combat railway just to learn how they are to do it in France. Its rolling stock consists of fourteen gasoline locomotive engines and more than one hundred cars



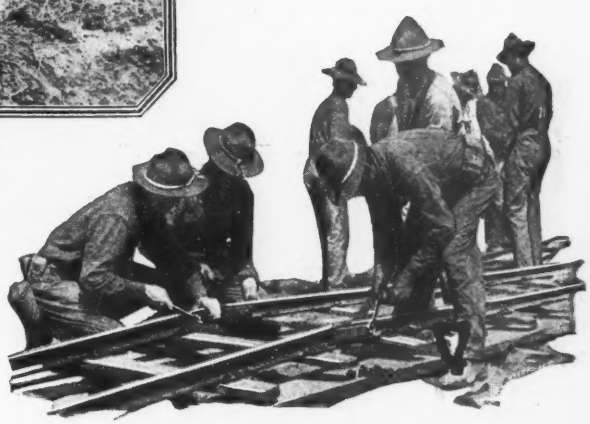
Machine tools are as necessary as bullets in this war of machinery. And so some of the men must learn how to run lathes and drills in collapsible machine shops

Who Are to Back Up the Army in France



Think of building such a trestle just for practice! It's part of the educational combat railway at Camp Humphreys, Va., which is located near the Potomac River

They will pull up stumps in France with traction engines, just as they are learning to do the trick at Camp Humphreys



Right: Yes, they teach them how to lay tracks, since many big guns are mounted on railway trucks on the West front

Trampling Out the Rice That Feeds Them

It's footwork that threshes rice in the Philippines. The laborers stand in a row and stamp the rice on the mat with their bare feet

He takes a bundle of rice, holds it in two sticks, and pounds out the grains of rice on a large stone

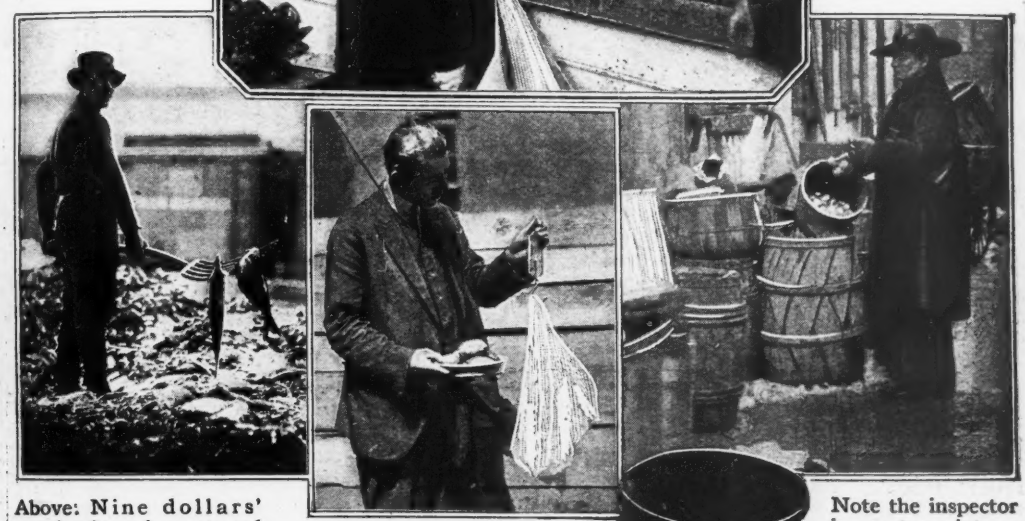
More footwork. The threshed rice falls through the meshes of the matting on the raised platform

Even the caribous trample out the rice. Evidently the Filipinos get tired doing it with their own hands and feet

Mr. Hoover, Please Take Notice

To the right: No bread in the garbage pail of New York's poor. They buy their bread by the slice, and eat every crumb. The foreign-born set an example to native Americans

Below: Inspectors found $20 worth of good food in the garbage containers of 163 New York families—bread, meat and vegetables. And this during wartime! Other cities are equally as bad



Above: Nine dollars' worth of good meat and fish was thrown away in one square block in Manhattan in a day. Did we hear somebody say "Food will win the war"?

The Food Inspector

Note the inspector in center picture. He took from four garbage cans 6½ lbs. of meat and the bread in the bag with 2 lbs. of boiled potatoes shown on the plate

In bread alone New York wastes 60,000,000 pounds in a year, and other cities are no better. We'll wager our best silk hat against a doughnut that Berlin has no such record

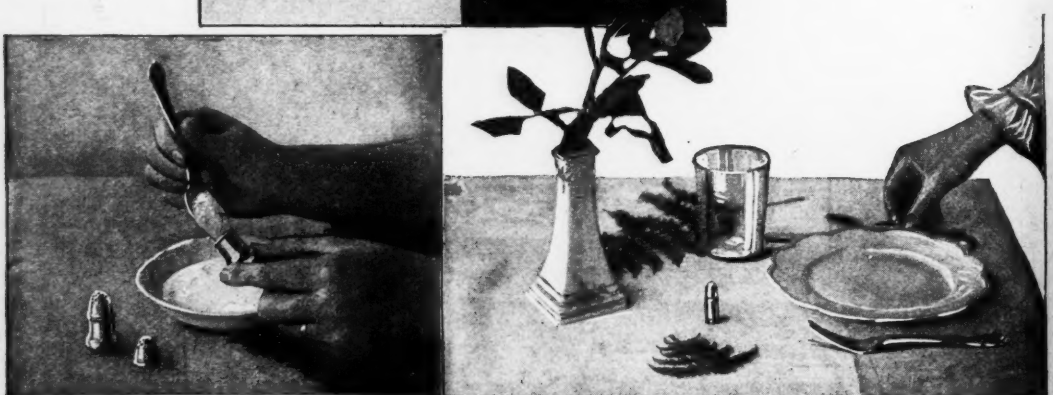
They Used to Plowshares. But Here Is What

To the left—Ella Wheeler Wilcox ought to write a poem about the roses in the shell case. We can't

Below—The souvenir collector lucky enough to get possession of a piece of shrapnel converts it into a candlestick holder

To the right—Well, well, we never thought they would play dice with bullets. Still, we've known 'em to play poker with matches for chips

To the left—We hope the bullet conveyed a message to the Kaiser before the cartridge case was turned into a pencil and eraser

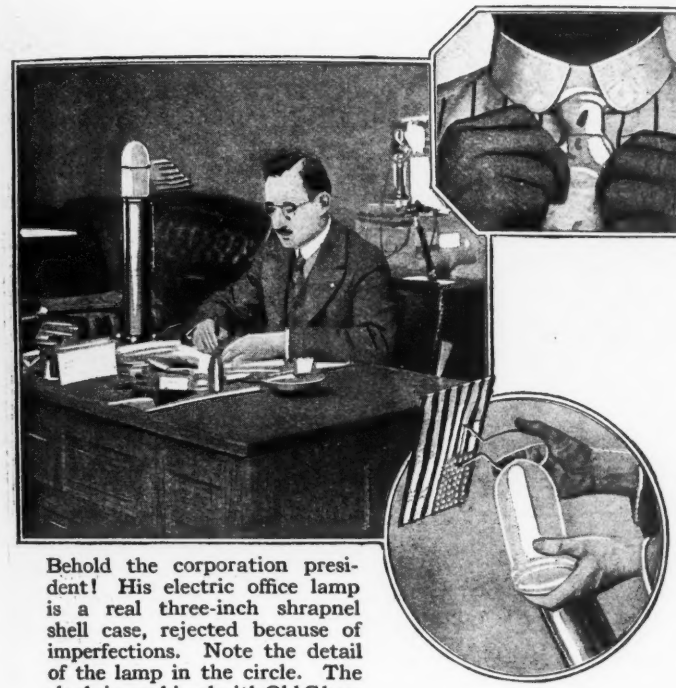


They even use cartridge cases as salt and pepper shakers. The shakers are finished with silver and take a high polish; the tops screw off in regulation fashion to permit refilling

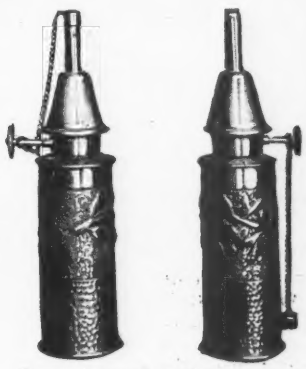
Beat Swords into Shells and Bullets—We Do to Them

To the right—Listen to "Over There" played on the bullet bazoo

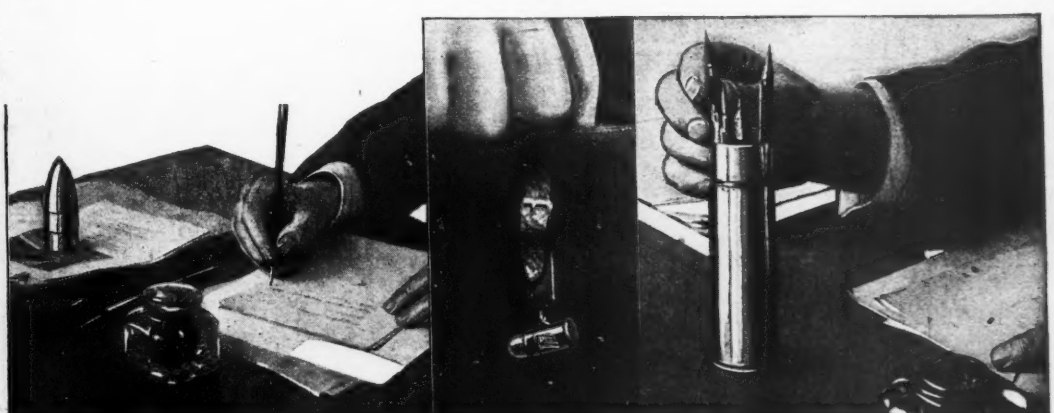
Below—We'd like to pin one on the German Crown Prince but not exactly in the same way



Behold the corporation president! His electric office lamp is a real three-inch shrapnel shell case, rejected because of imperfections. Note the detail of the lamp in the circle. The shade is combined with Old Glory



Our esteemed contemporary, Wilhelm von Hohenzollern, has no objection to our making lamps out of shell cases

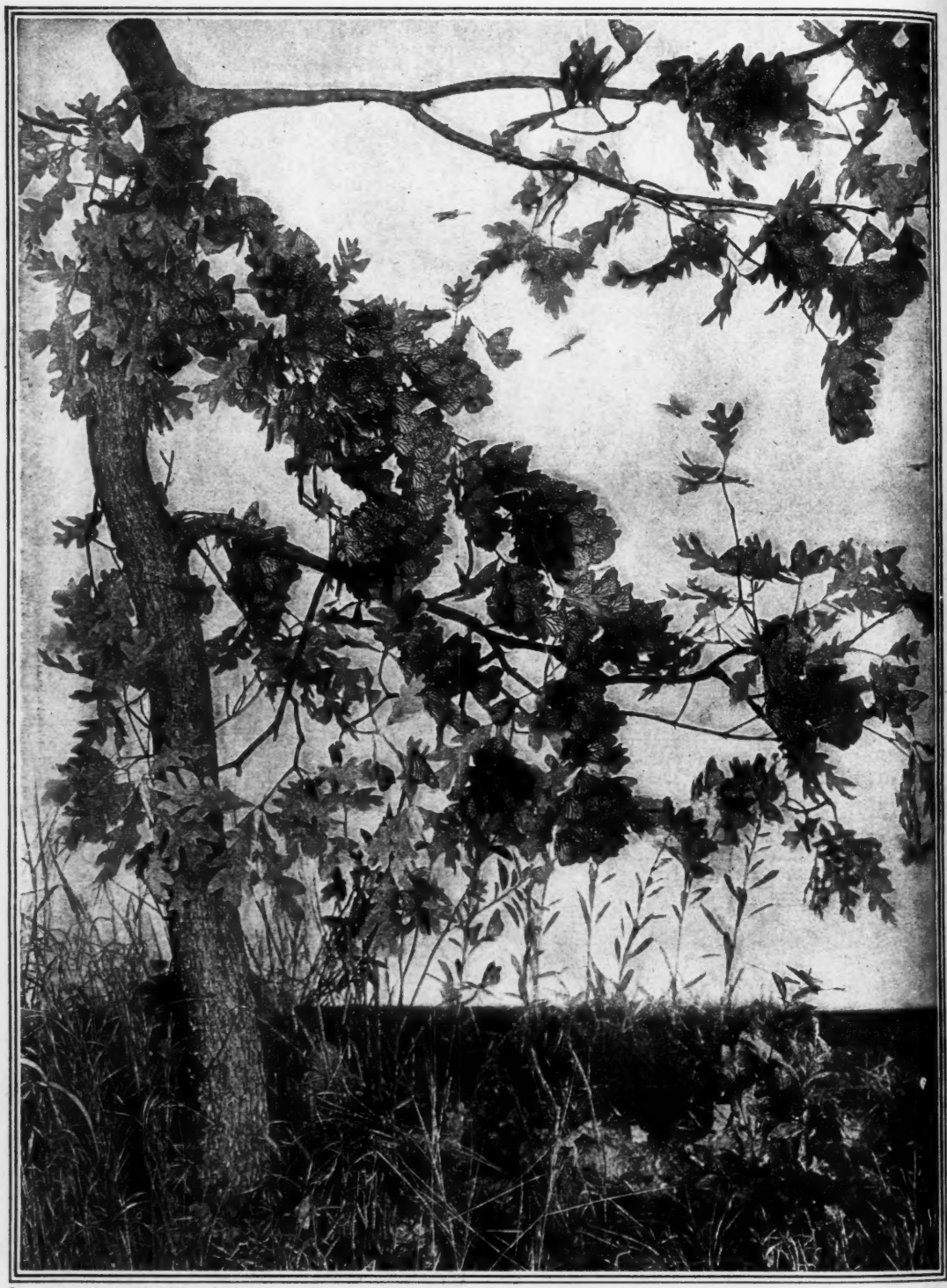


A chance to moralize on the degradation of the noble bullet

Should be in a soldier's pistol

Many shell cases are rejected by the inspectors. Use one this way

Butterflies That Go South Every Autumn



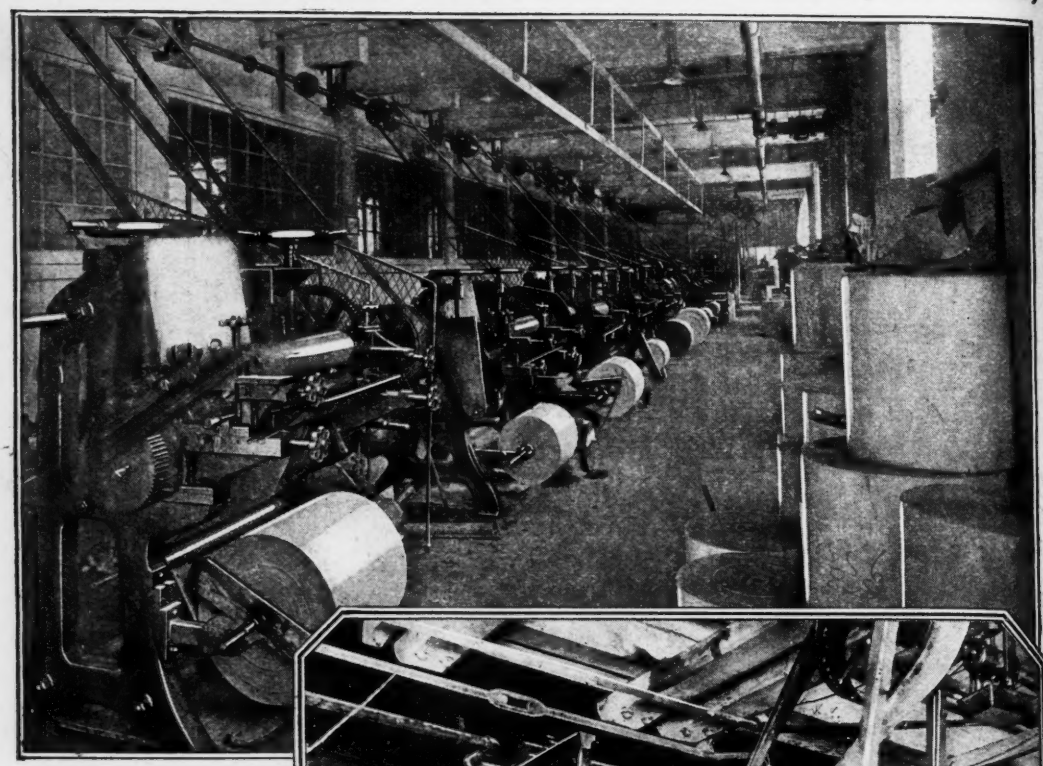
By courtesy of Am. Mus. Natural History

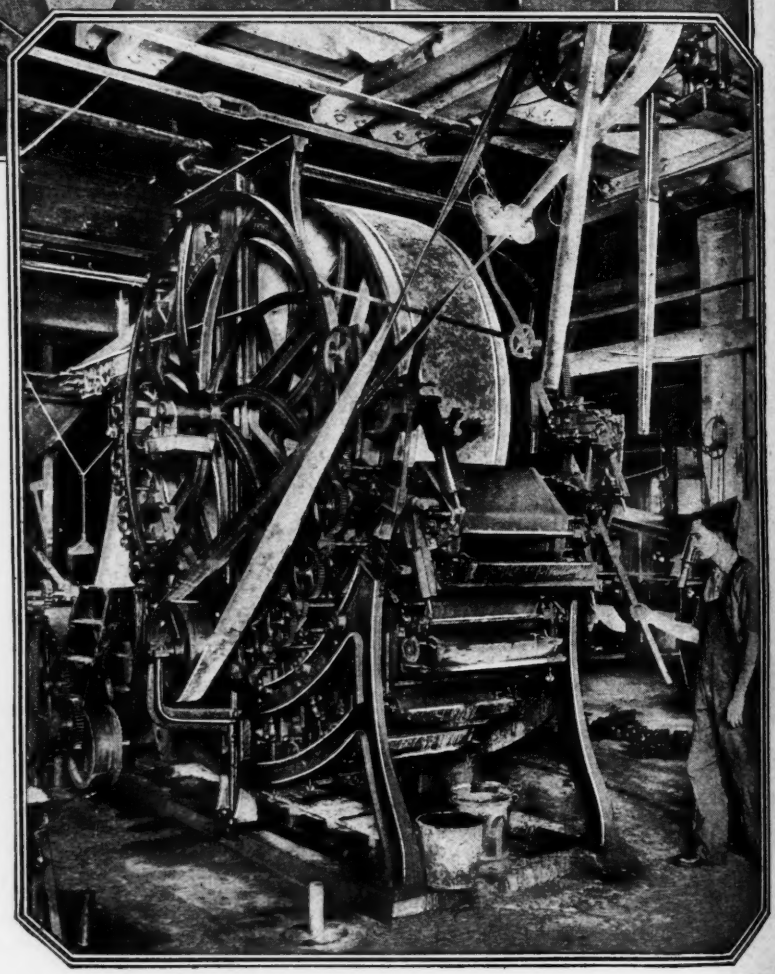
Butterflies migrate as birds do. Thousands of the American monarch butterflies gather annually on the branches of certain trees as though by appointment and their color blends so perfectly with the brown leaves as to be indistinguishable from the foliage of autumn

Not Monks, But Camouflaged Artillerymen

The object of camouflage is to deceive the enemy, and the method employed for that purpose necessarily depends upon the conditions and circumstances in each individual case. No hard and fast rules can be laid down and the success of the camouflage depends upon the skill and imaginative power of the officers or men attempting it. The group in the picture with the anti-aircraft gun may not appear sufficiently disguised to deceive a reader, but it is safe to say that, to an observer in an airplane, the group appeared like lichen-covered rocks around a tree-stump

Miles and Miles of Printed Birds, Flowers,

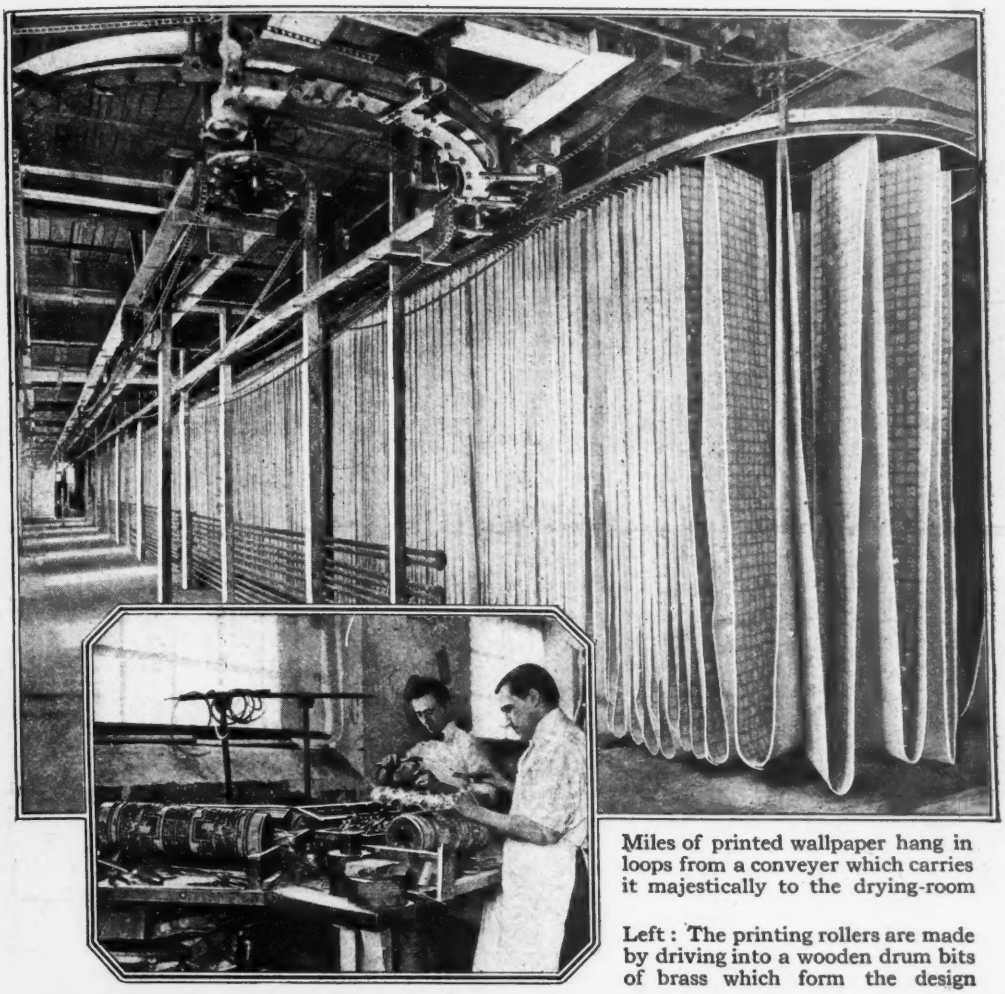




Wallpaper is printed on presses that are not very different from other presses. The paper is fed in a continuous roll One color is printed at a time, the superposed colors (as many as fifteen are employed) reproducing the effect of the design made by the artist. The basis of the colors used is a fine white clay tinted with aniline and other harmless dyes

To obtain the effect of a woven fabric, grained leather, or brush-stippling, etc., the paper is often embossed. The paper passes under a steel roller or drum which has been engraved so as to press the desired design into the surface of the wallpaper

Stripes and Animals for the Nation's Walls



Miles of printed wallpaper hang in loops from a conveyer which carries it majestically to the drying-room

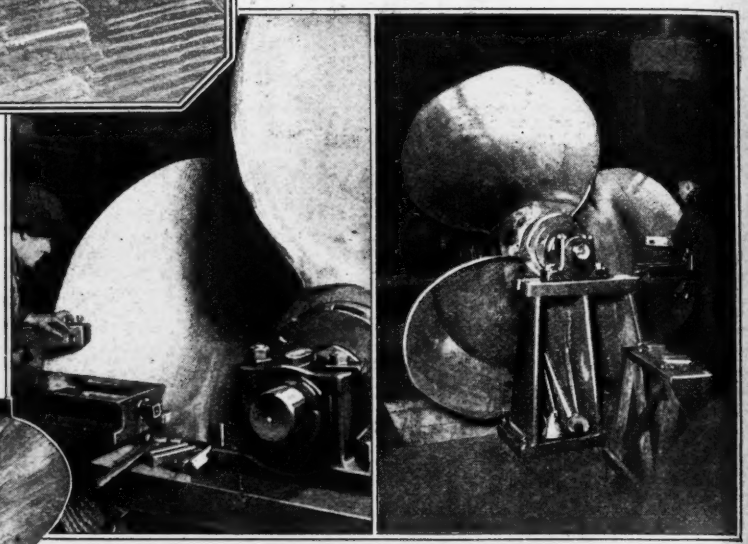
Left: The printing rollers are made by driving into a wooden drum bits of brass which form the design

The printed paper is fed in a wooden trough and is mechanically wound up by each girl on a rapidly revolving steel rod. When the girl sees a mark in the margin she stops the rolling machine and cuts the paper off. Then she has one of the rolls that you buy

Out of Sight Usually Is But It Is Too Important

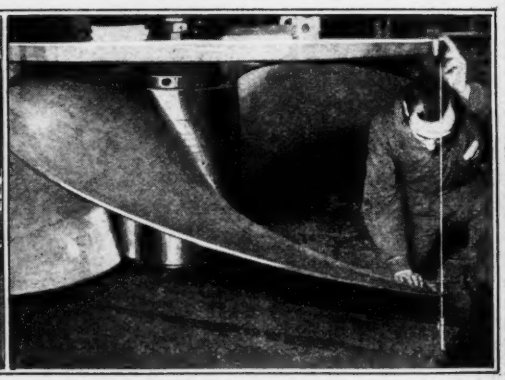
To the left: A ship's propeller must be shaped as carefully as a violin. Old Bill, here, is chipping off excess metal with a pneumatic chisel. But how does he know to what depth he must cut? See the figures in the squares? They tell him how much to cut

Below: Measuring the pitch of a propeller to determine its power



To the right the machine which smooths the blades; to the left a "close-up," as they say in the moving picture studios, of the machine's business end. In this manner the propeller blades are given an absolutely true screw surface by the machine

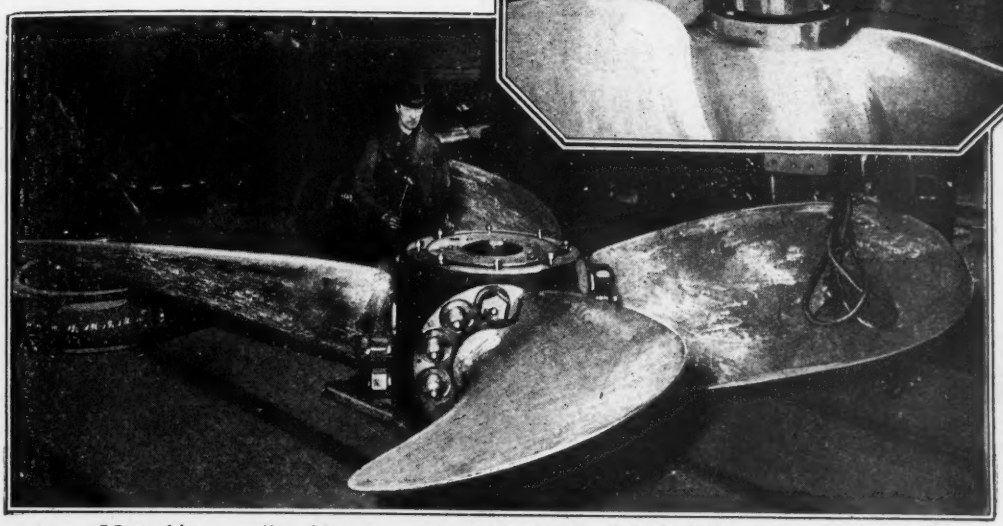
If the point of the rod doesn't catch the bit of paper held on the blade the pitch is wrong and somebody will soon hear from it



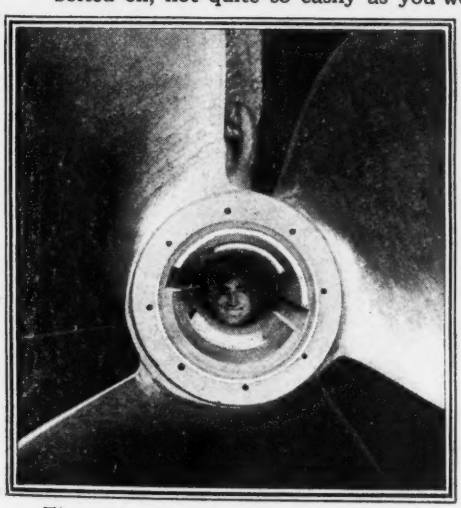
Each blade is part of a screw. Its pitch is the distance through which it screws itself in one revolution. Pitch means pulling power

Every Ship's Propeller; Ever to be Out of Mind

The cone is called a fairweather because it makes fairweather for the propeller by keeping the water from forming little whirlpools behind the "boss" or hub. Such whirlpools are as bad for the propeller as for a swimmer



Most ship propellers have four detachable blades. If a blade is lost another can be bolted on, not quite so easily as you would change an automobile tire, but almost



The hub of a propeller is tapered and wedged on the shaft by means of keys that fit in the slots. The size of this shaft is indicated by the man's head, which it sets off like a frame

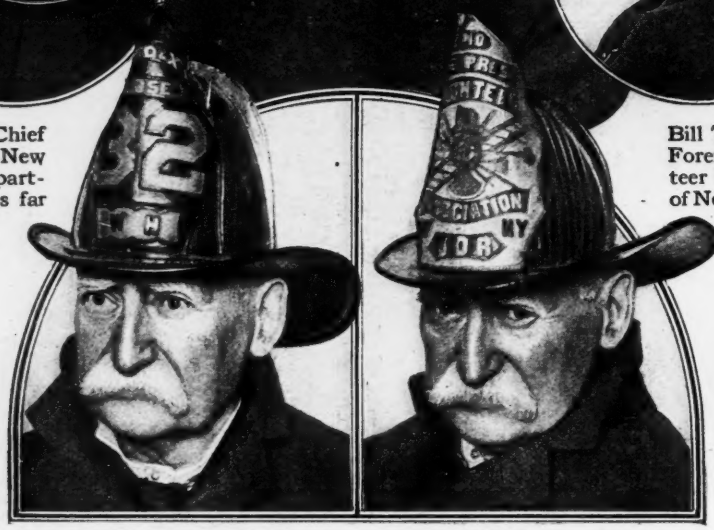
Not until the government inspector stamps it with the Government's official acceptance stamp, having an anchor as a device, is the propeller permitted to be fitted to its shaft

How They Wore 'Em Away Back in the Fifties

This is the hat James F. Wenman, ninety-four, wears on Washington's birthday. His father, Uzziah sported it as foreman of Franklin Engine No. 39 in 1818

Worn in 1858 by a member of Warren Hose Company No. 33 of Philadelphia

It came from Paris. In 1835 it was presented to Hook and Ladder 11 of New York



Harry Howard, Chief Engineer of the New York Fire Department, wore it as far back as 1834

Bill Tweed's. Bill was Foreman of the Volunteer Fire Department of New York. It dates back to 1851

James T. Watkins, aged 88 years, wears this hat once a year when the New York Exempts parade

The fire helmet the Volunteers of New York's Fire Department wore away back in the days of '58

The Ford Idea Applied to Art

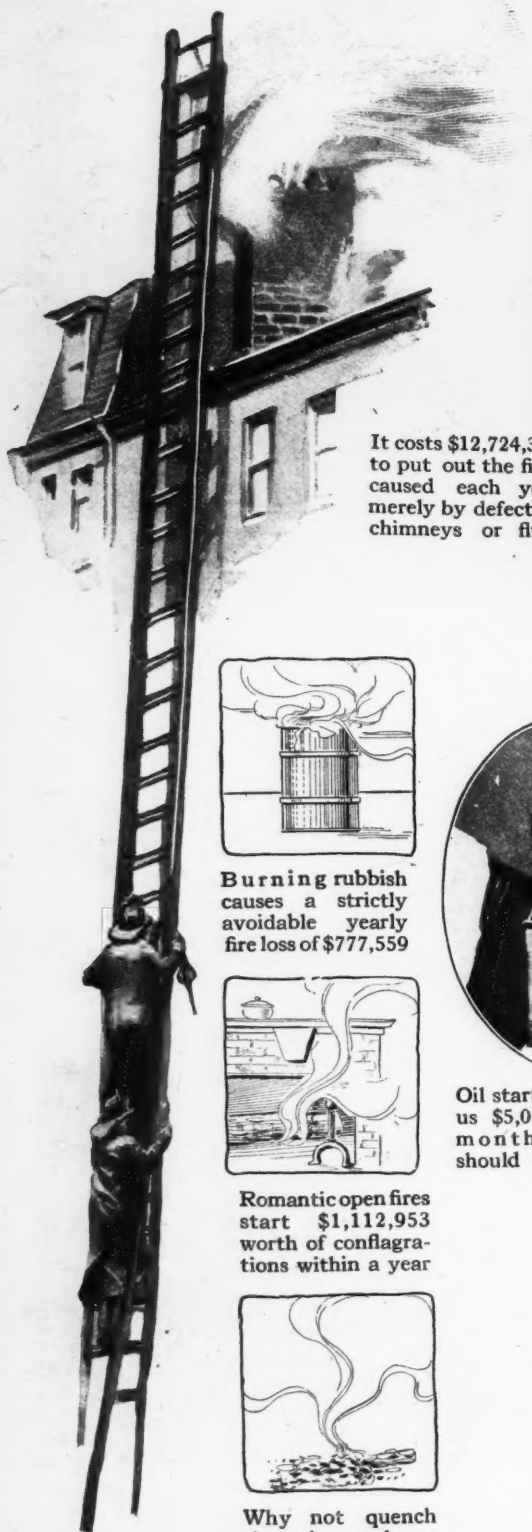
Right: Here we take you aside and show you how the marble statuettes that you buy on some street corner are made. They are cast—not carved. The mold comprises two parts—an outer casing of plaster-of-paris and an inner mold of rubber. In the picture the two are separated for your inspection

What's in the pitcher? A solution composed chiefly of marble dust—mere waste. Giuseppe, here, pours the solution into the molds like so much water. What happens then? See the pictures below

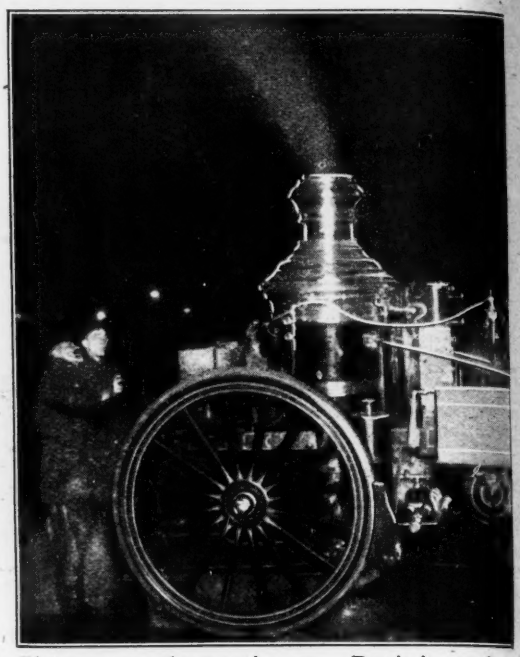
Giuseppe pulls the rubber mold away when the solution hardens. Behold the famous group!

Now come the scraping and the polishing, and the result is a finished work of art

Every Year One Hundred and Sixty Million Dollars



It costs $12,724,317 to put out the fires caused each year merely by defective chimneys or flues



Picturesque and romantic—yes. But is it worth to put out partly preventable fires and $60,466,054 preventable fires? That's what our clanging

Burning rubbish causes a strictly avoidable yearly fire loss of $777,559

Oil started fires that cost us $5,070,100 in twelve months—money which should have been saved

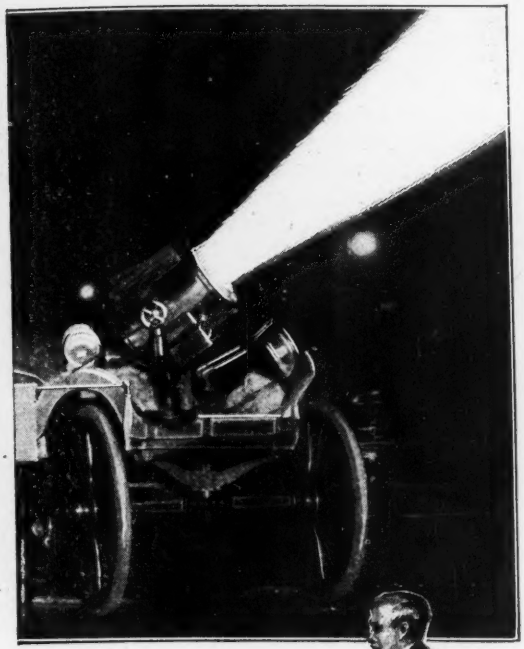
The pictures on this page and the next are based on statistics gathered by the National Board of Fire Underwriters

Romantic open fires start $1,112,953 worth of conflagrations within a year

Why not quench the embers and save $1,140,194 a year?

Would you do this? Others have done it. The result? Annual fires costing $2,142,958. The Actuarial Bureau of the Board of Fire Underwriters receive 2500 insurance claim reports every day

Goes Up in Smoke—All a Preventable Loss

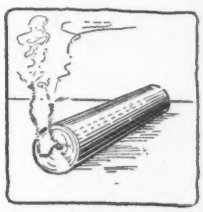


$99,606,293 annually to put out strictly fire engines mean

You've seen it done—throwing a lighted match on a roof. That costs us for fires every year $7,355,037

You would think that everyone knows that molten metal can burn. Yet, the metal ladle burns up every year $155,183

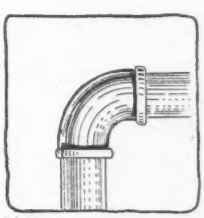
The old familiar story of the cigar on the table. Even sensible business men do it. Annual fire bill: $8,588,375

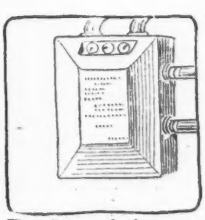


Patriotism is expensive when it's careless. Fireworks mean $375,409 a year in needless fires

Fires are started by stoves, furnaces, boilers and their pipes through sheer carelessness in most cases. Annual fire bill: $11,204,875

Steampipes: $413,176 a year in fires. Proper inspection and insulation would save this money





Don't read the meter by candle light. Gas starts fires that cost on an average $1,815,597 a year

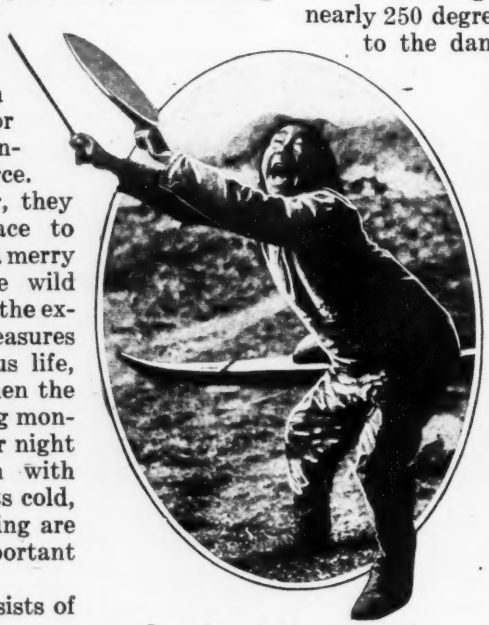
Grease: $552,130 a year. Too much

Primitive Peoples Must Have Music and Dancing

TO the Eskimos, as well as to other primitive peoples, music and dancing are important mediums for the expression of their feelings, and much needed outlets for their excessive energy and vital force.

In the summer, they ramble from place to place, engaged in a merry struggle with the wild beasts, and enjoy the excitements and pleasures of an adventurous life, but in winter, when the long and appalling monotony of the polar night overpowers them with its stillness and its cold, singing and dancing are their most important safety-valves.

The music consists of singing in unison, accompanied by rhythmic tapping on a primitive drum. Dancing almost always is accompanied by the same chorus.



In spite of his apparently woful expression, this Eskimo is indulging in a joyous dance to his own music

The illustration shows an Eskimo from West Greenland, singing, dancing and beating his drum.

The drum consists of a frame made of whalebone covered only on one side with a piece of gutskin. The drumstick is made of driftwood. It is beaten on the frame, not on the drumskin.

The Eskimo dance is a series of somewhat primitive movements, but it is very expressive of joyous emotions and excess of energy.—CHRISTIAN LEDEN.

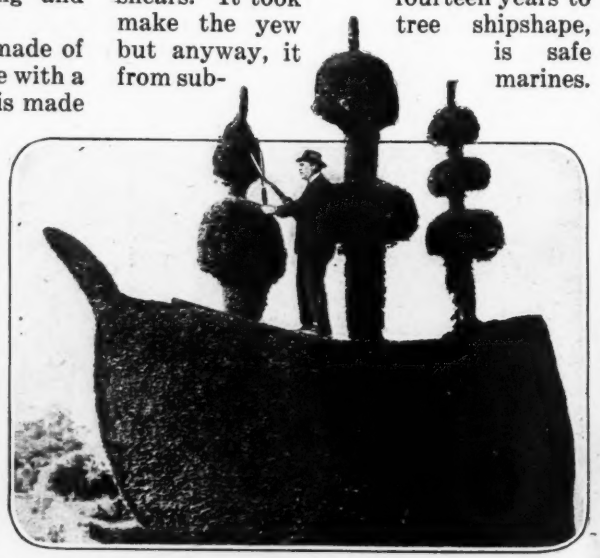
A Few Facts About Picric Acid, Base of Explosives

COAL-TAR, among many other things, contains phenol, and when phenol is nitrated picric acid is produced. This acid is a powerful explosive, but it has the objectionable quality of forming highly sensitive explosive compounds with the metals it touches, so that when used as a charge for shells it has to be coated with some non-metallic paint in order to prevent premature explosions.

The melting-point of picric acid is nearly 250 degrees Fahrenheit. This adds to the danger of its use, since it is desirable to melt it in order to pour a concentrated charge into the shell to increase the explosive force. For this reason, picric acid is usually combined with various substances to lower its melting-point. Lyddite and melinite are two of the compounds.

They Trim This Ship's Sails with the Shears

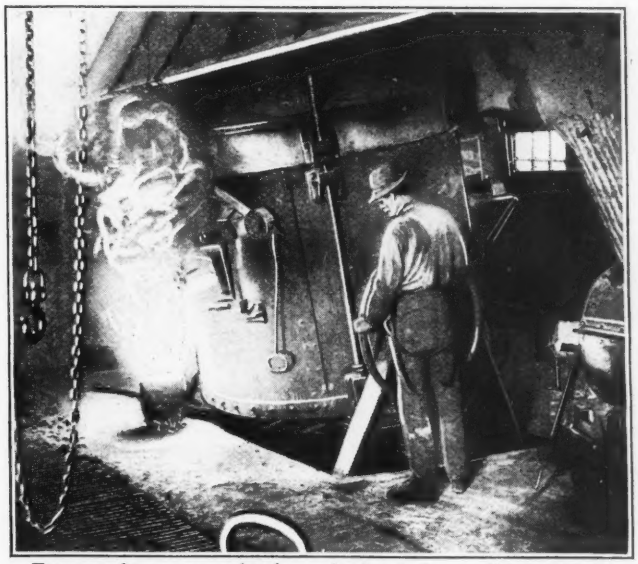
THIS is not the captain of the *Pinafore*, but an ingenious old gardener who has trained a yew tree on an estate near Cadnam, England, into the semblance of a ship. The gardener may be observed just abaft the foremast engaged in trimming something that may be a sail with a pair of hedge shears. It took fourteen years to make the yew tree shipshape, but anyway, it is safe from submarines.



Its hull is a yew tree's branches; its captain and trainer an English gardener

The Crucible Gives Way to Electric Furnace in the Brass Foundry

FOR many years brass, copper, or similar metals for pouring into castings or ingots have been melted only in crucibles. This is still the practice in many plants and foundries in this country. Until recently no other method would serve because of losses due to too high a temperature or to some other cause.



Brass and copper used to be melted only in crucibles; now an electric furnace has been developed, which does much better

But now an excellent and superior electric furnace has been perfected which is successfully melting and pouring brass, and which bids fair to make rapid progress in displacing the crucible.

Electric furnaces have generally developed such a high temperature that much of the metal was lost by volatilization, or spoiled, but this one overcomes all such difficulties.

In such a furnace several thousand pounds can be melted at once, whereas in the crucible no more than one hundred pounds can be so treated at once. The new process, which is the invention of an American, is more efficient, economical and much cleaner than the old. Its merits are such as to be sure of finding recognition from up-to-date foundrymen.

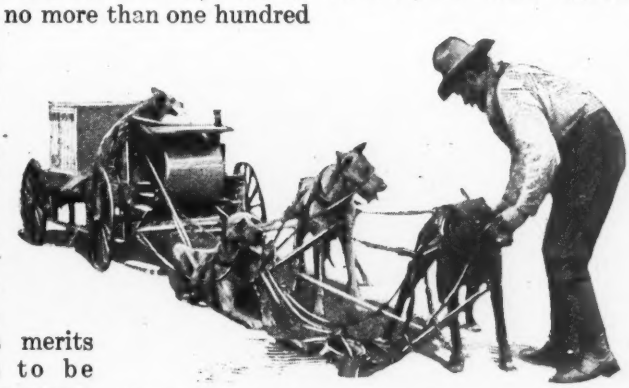
Draft Animals in the War. Five Millions on West Front

THE British have two million horses engaged in this war, according to Premier Lloyd George in a recent statement. It is estimated that the number of horses and mules in service on the whole western front is close upon five millions. A great many horses have been shipped to Europe from America—just how many it is hard to say, and doubtless many were drowned.

A Six-Dog-Power Sledge-Wagon For Overseas Service

READY for Flanders mud or Alpine snow, this dog-drawn ambulance has been given to the American Red Cross for foreign service. It was built by Allen M'Mullen, a trapper, who had handled dog trains in the far North and who took a special delight in training the six great Danes, all blue ribbon winners, that furnish the motive power.

To prove the value of his gift, he drove his dogs from Albany to New York before he turned the outfit over to the Red Cross together with a sum of money that he had collected during the trip.



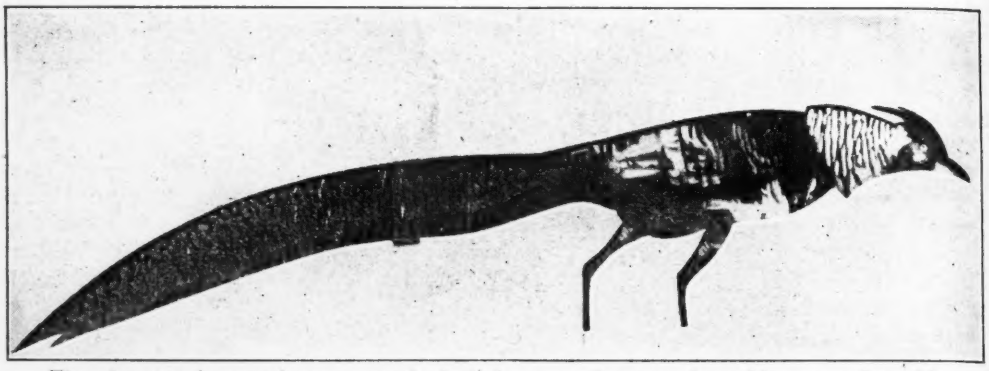
© Int. Film Serv.

Remove the wheels and this dog-drawn vehicle is all ready for a snow storm or a mud swamp

Dame Nature—Instructor in Camouflage

She knew all about the art and her children practised it long before man gave it a name

By A. M. Jungmann



The pheasant is conspicuous enough, isn't he, now that you have him away from his natural background? Now look for him in the picture below and see if you can find him

WHY does the savage paint himself in gaudy colors when he goes on the war-path? Why is the leopard spotted and the zebra striped? Why is the wild duck a mottled dark color on top and light beneath? For the same reason that our "tanks" and ambulances are being painted with stripes and splotches of vivid colors—to make them invisible to their enemies.

Before the war created the French word camouflage, naturalists spoke of "concealing coloration" and "mimicry." In the piping days of peace an American artist, Abbott H. Thayer, devoted a great deal of time to the study of concealing coloration. An essay published by Mr. Thayer in 1896, "The Law Which Underlies Protective Coloration," entitles him to the distinction of being the father of camouflage. Moreover, in 1909, Mr. Thayer's son, Gerald H. Thayer, published a book on his father's researches, "Concealing-Coloration in the Animal Kingdom," which is profusely illustrated by both Abbott H. and Gerald H. Thayer. In America this book called forth a storm of protest. European scientists were more impressed by the points Mr. Thayer brought out. Professor J. Graham Kerr of Cambridge and the University of Glasgow, seeing the military value of Thayer's law, tried to persuade the British Government to create a special bureau to develop war camouflage on the principles laid down by the Thayers.

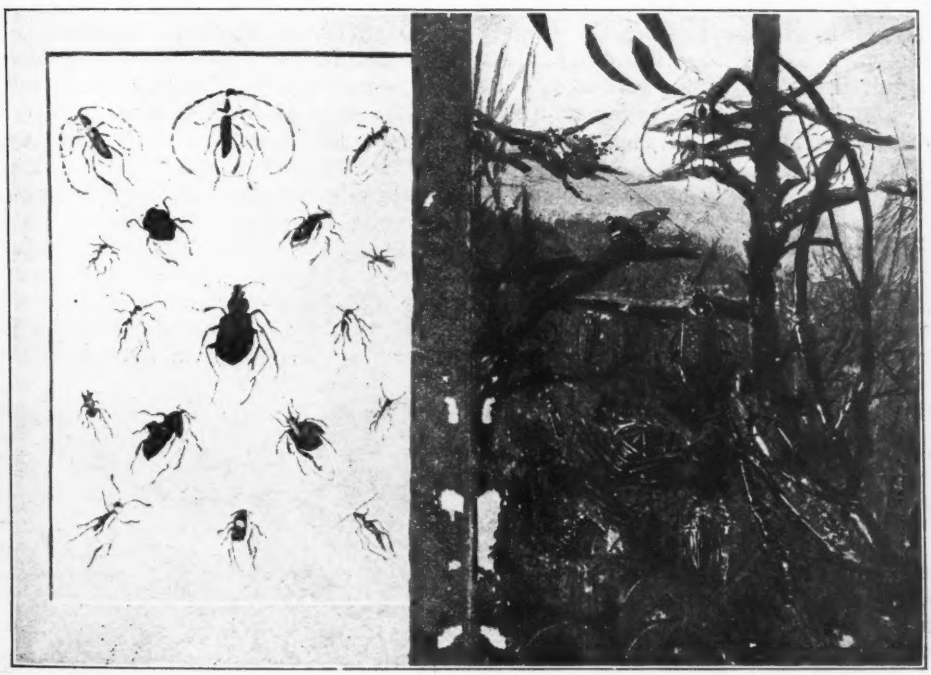
This is not just a painting of a wood scene. It's a portrait of a pheasant at home—the pheasant in the picture at the top of this page. The colors blend perfectly with the scenery

This book is also known to have played a leading part in the development of camouflage in Germany! There are signs that the Germans have mastered the significant *laws of disguise* which this book discloses, more thoroughly and more effectively than any of the other warring countries.

In this country Mr. Abbott Thayer has been actively engaged in working out problems of military camouflage and many of his designs are now in use by both the French and the British forces at the front. He points out that the reason the rabbit at rest on brown turf, the copperhead snake among dead leaves in the forest, and the birds in their native haunts are so inconspicuous that unless they move it is very easy to overlook them, is because these animals wear a picture of their background. His remarkable nature paintings, some of which are reproduced here, prove his point conclusively. To quote Mr. Thayer: "The study of protective coloration is in fact the study of nature's scene-painting on the coats of animals."

It is easier to conceal a flat object than it is to conceal a round, solid form. And here comes in the principle, discovered by Mr. Abbott Thayer, called *counter-shading*. As Mr. Thayer says: "The roundness and solidity are plainly shown by lights and shadows. Tinker as we will in the attempt to cover the object with a picture of its background, it still insists on standing out in its own proper place as a solid thing, with the lighted upper surface facing towards the sky, fading down into darker and darker shadows on its under side. . . . On whatever portions of the object are most brightly lighted, there we put the darkest paint, and on whatever portions are most darkly shadowed there we put the lightest. *Pure white* pigment is as a rule required to lighten-up the extremes of shadow. Thus we *paint the shadows out of sight*, and the high-lighted areas likewise, with intermediate shades for intermediate portions; and the result is a rounded object that *looks* exactly like a *flat* one. It can then be "obliterated" by a background-picture just as the flat one was, the picture, however, having to be made consistent with the countering of lights and shadows on the rotund surface."

Our Army recognizes camouflage as an important branch of military science.



There are seventeen bugs in the picture on the right. The picture on the left will help you to find them. The positions of the bugs are the same in both pictures

These girl finger-print experts of the Navy make a business of holding sailors' hands against the ink

If You're in the Navy These Girls Have Your Finger-Prints

TO the four girls in this picture belongs the Navy record for holding hands. It is sense not sentiment that moves them, since they are the finger-print experts of the service and have recorded, classified and filed an impression of the digits of every bluejacket from the admiral down to the latest recruit. The entirely painless operation that the young man is undergoing will be finished in exactly five minutes after it began, and in another five minutes the young women will be able to tell whether the young man is a repeater, for their system is one of ready reference.

The finger-print experts are Miss Blanche Donohue and Miss Marie Dahm, of New York, and Miss Blanche Stansbury and Miss Julia G. Boswell, of Alexandria, Virginia.

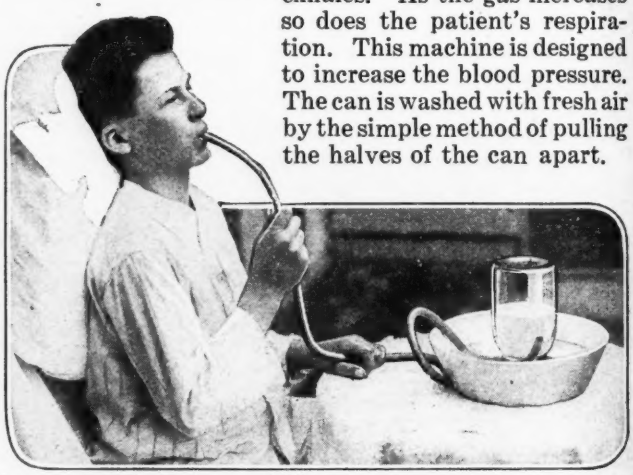
Blow Bubbles and Heal Your Wounded Lungs

SIMPLE methods have been devised for treating wounded soldiers at the front. Those suffering from wounds in the throat and chest can improve their condition by blowing bubbles in a bottle of water, according to Dr. Pescher, a French surgeon.

The bubble-blowing device is simply a long rubber tube attached to a bottle that rests in a basin. In order that the patient may receive the full benefit of the treatment his body should be erect and his chest thrown out so that the lungs may be well expanded. The best effects are obtained by inhaling through the nose, slowly and regularly, and blowing through the tube, compelling all the water in the bottle to run off into the basin below. This exercise should be practiced thirty times during each treatment. When the lungs improve, a larger bottle is used.

In making this apparatus ready for use it is necessary to pour a small quantity of water into the basin, and then place the water-filled bottle, mouth down, in the bottom of the receptacle, taking care that the water does not run from the bottle. One end of the tube is placed in the neck of the bottle and the other in the mouth of the patient. Treatment given in this manner will aid the patient to regain his breathing facilities.

Dr. William T. Porter uses a tomato can cut in two, each half being shoved over a collar of tin so that it can be drawn out. A rubber tube enables the patient to breathe in and out of the can, filling it with the carbon dioxid he exhales. As the gas increases so does the patient's respiration. This machine is designed to increase the blood pressure. The can is washed with fresh air by the simple method of pulling the halves of the can apart.

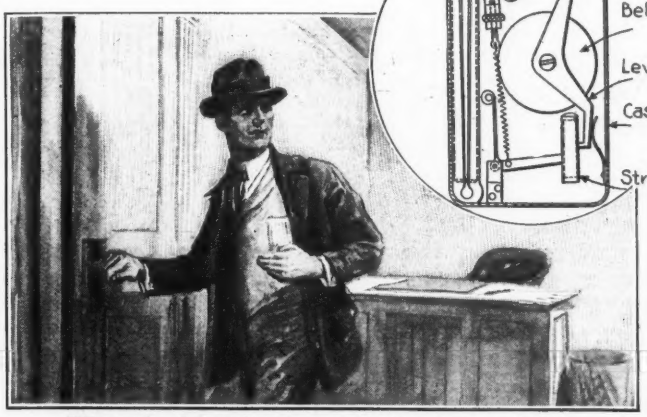


To strengthen his lungs the wounded soldier blows the water out of the bottle 30 times in one sitting

The Bell Rings When You Forget Your Fountain Pen

HAVE you the habit of walking away and leaving your fountain pen on a strange desk? If so, you will be interested in the device which Dermot Donelan of London has invented.

You must, of course, use a special kind of fountain pen—one which has a case with spring holders having one side free to move by means of their own elasticity. Chains attached to these holders are fastened to a lever which, by means of a spring, holds in place a flexible striker for a bell.



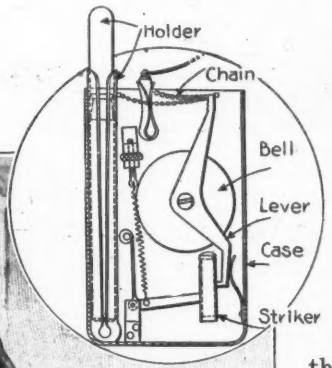
When the fountain-pen owner rises to go a bell in his pocket reminds him that he has forgotten his pen

When the pen is in the case and the plug for the cover has been put on, the holders are forced away from the sides and the chains are slackened. However, when the pen or the plug are removed the holders contract and tighten the chains. Then the lever is drawn away from the striker and the latter is free to come in contact with the bell. It does not sound, however, as long as the person carrying the case is still. But when he moves, the striker sets up a pendulum-like motion and the ringing of the bell follows, calling attention to the fact that the pen is not in the case.

It seems to us that this device is more ingenious than useful. Why not an umbrella that cries when it is left behind? It would be moreserviceable than the fountain pen bell that rings.

Relieving the Hand That Rocks the Cradle

WONDERFUL as this age of invention is, no one dreamed that some day the wealth of energy wasted by the swinging of a rocking-chair would be intrepidly harnessed, subdued, and regulated to do the work of mankind. But, nevertheless, this very thing has been accomplished by an inventor in the State of Wisconsin.



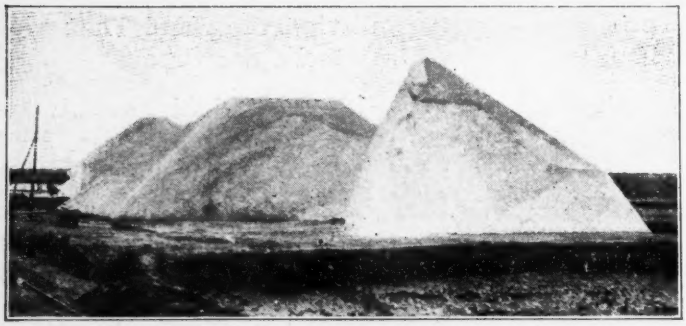
Briefly told, the invention consists of a telescoping rod hinged at one end and clamped to the rungs of a rocking-chair. The other end is fastened to the front axle of the baby-carriage.

It is clear that a movement of the rocking-chair will impart a backward and forward movement to the baby-carriage. The plan is an excellent one, since from your seat in the rocker you are not obliged to watch the contortions of the baby's face while it is crying itself to sleep.

By grasping the handle of the baby-carriage it is possible to put the baby and grandma to sleep with a single sweep so to speak. The contrivance will work equally as well from either end.

The tired housewife will no doubt welcome this contrivance with open arms. What will these inventors do next to make baby-minding a pleasure instead of a drudgery?

The war bride knits socks for hubby at the front and puts baby to sleep at the same time as she rocks



© Brown and Dawson

The big whitish heaps are salt which has been obtained from sea water by evaporation and is ready to be shipped inland

it still contains about fifteen per cent. of impurities it is shipped in large quantities without further refining.

A considerable part of the crude salt is used locally for curing and pickling. The refining of the salt for table use is left to the numerous small local refineries scattered throughout the country.

Drying Sea Water to Get Salt—the Spanish Way

THE use of salt for seasoning and preserving foods is so ancient that the earliest written records refer to it. For many centuries practically all the salt used by the human race was procured by the evaporation of sea water. This method of obtaining salt is still employed in many localities where the conditions are favorable. A flat stretch of sea coast and a hot and dry climate are necessary if salt is to be gotten from sea water. An ideal locality for this industry is the coast on the Bay of Cadiz, Spain, where the picture of the salt hills was taken.

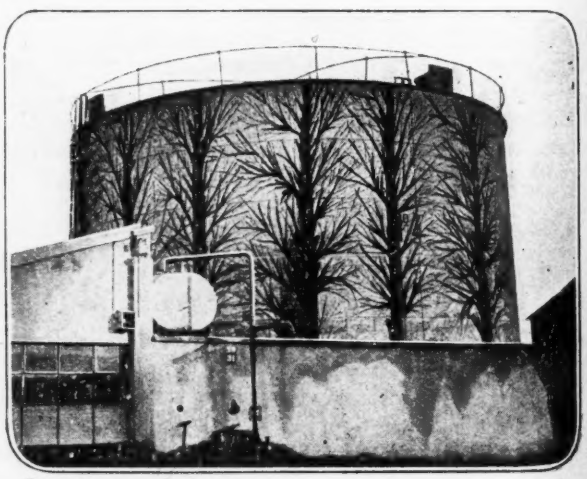
The sea water is allowed to collect in shallow basins, barely above high water mark. As the water evaporates, the various salts contained in the sea water crystallize out and form a crust, which is removed and shoveled in small heaps. There the salts undergo the first stage of purification. The edible salt is drained from the other salts which constitute the greater part of the impurities. The edible salt crystallizes out first, while the other salts retain the water and form a concentrated brine which is allowed to run into ditches dug for that purpose.

The partly purified salt is then gathered into large heaps, several of which are shown in the picture. Occasional rains wash out the more easily soluble impurities, and the hot sun dries the salt on the surface of the pile. Although

A Roumanian Oil Tank That Was Camouflaged Into a Grove

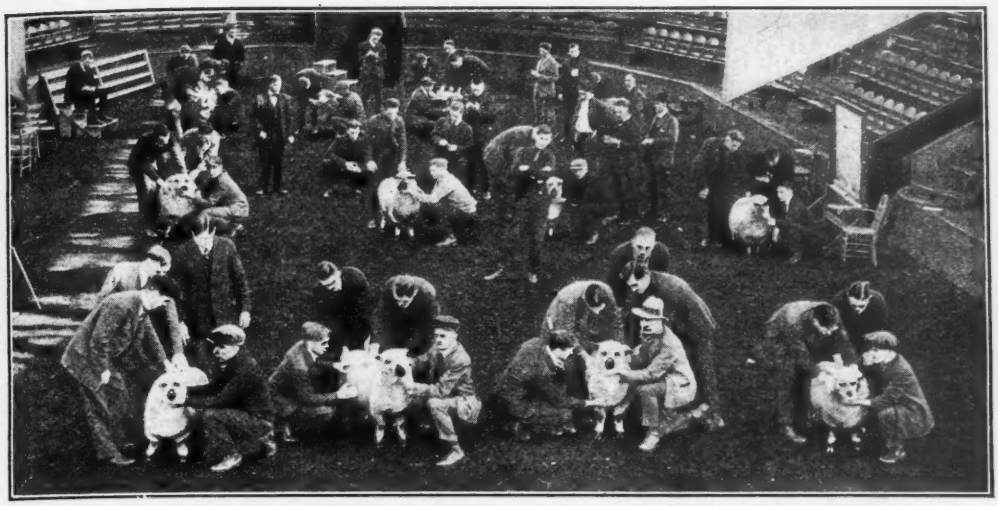
THE art of camouflage has been practised in this war by all belligerents more or less skilfully, and particularly on the West front it reached its highest development. But even in the Balkan countries the value of camouflage was recognized and the accompanying picture shows that the Roumanians were not unskilful in disguising important buildings and other structures—oil tanks, for instance. The little grove painted on the sides of the tank is perhaps a trifle stiff, but at a distance it may, indeed, mislead the enemy bent upon destruction.

Camouflage of this kind may afford fairly good protection against an enemy on nearly the same level, but scarcely against an aviator or observer in a balloon.



© Underwood and Underwood

At a distance this oddly decorated oil tank may look enough like a grove to deceive the enemy



Students at Purdue University judging sheep in the Judging Competition, which is held at the close of the Winter course in Animal Husbandry

Learning How to Judge Sheep in a University

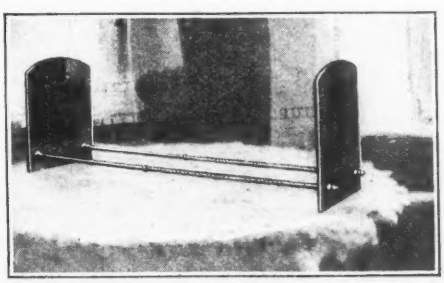
NOW, as never before, the country needs both wool and mutton. Our soldiers require wool for uniforms and blankets, and both the men in the service and the noncombatants must have meat. Therefore, the raising and breeding of sheep has become a very important and profitable branch of farming. The United States Department of Agriculture is now actively engaged in educating farmers and particularly farmers' sons, in the care and selection of sheep. Sheep-judging has been made a part of the regular secondary, or high school work in the sheep-raising districts. The students are taught the proper way to judge the merits and demerits of any given breed of sheep, from the point of view of the wool production and for butchering. By means of charts and diagrams they are first taught the names of the different parts of the carcass.

In the judging of wool sheep care is taken to instruct the students in the different kinds of wool and their characteristics, as well as the breeds of sheep that are most desirable as wool producers.

A Book-Rack Which Adjusts Itself Automatically

TABLE book-racks are always a convenience, and can be made very attractive and ornamental too. With the ordinary rack, however, the removal of two or three books causes general disorder, for all the rest fall over and make the appearance anything but prepossessing. Here is a rack that precludes all that by adjusting itself to the number of books that it contains.

It is made with the usual wood or metal ends, which are connected by two telescoping brass tubes. Inside the tubes are coil springs which are fastened to the end-boards, and which tend to draw them together. The spring is not so strong that it interferes with the removal of the books, but there is sufficient tension to cause the ends to rest snugly against the end books, and close up as the books are removed from the rack. The ends can be covered inside with felt to prevent the possibility of scratching the book covers.



Coiled springs inside the brass tubing hold the book ends firmly against the books

When not in use this adjustable rack takes up less space than the ordinary rack and costs less for transportation.

Every Auto Has a Picnic Seat All Its Own

MUCH of the comfort in life comes of making good use of the things we have. Mrs. William J. Chievitz, of Cleveland, Ohio, proved that when she found that the seat cushions of her automobile and two sticks made the most restful of outdoor couches. No need, if you follow her plan, to take along even a folding camp chair when you motor off for an afternoon in the woods or at the seashore since the cushions are always with you, and it must be a desert place indeed that won't provide the two sticks necessary to prop up the back of the improvised divan.

This most comfortable outdoor seat is made of two automobile cushions

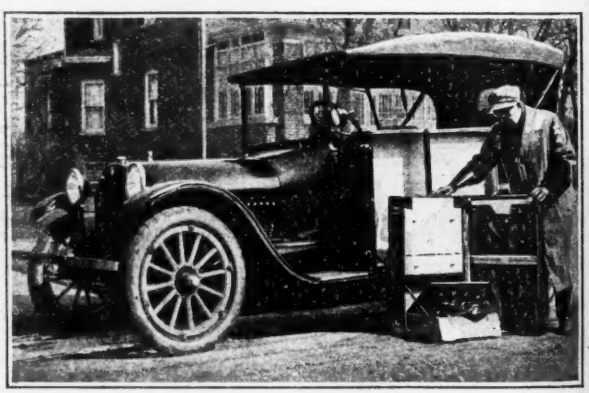
Pick your sticks right and you can adjust the back to your own idea of luxury

A comfortable seat is very desirable on a picnic. A good plan is to prepare two stout sticks of a proper length which can be carried in your automobile for this very purpose. The length can be determined by removing the seats, adjusting the cushions at the proper angle, and cutting the sticks to fit.

Carry a Wardrobe on Your Car's Running-Board

TOURISTS traveling long distances in their automobile do not mind wearing old and even shabby clothes while they are riding. But, when they stop at some fashionable hotel or at the elegant summer home of their friends, they want to appear at their best. How to carry finery along on a long trip and how to keep it unwrinkled and free from dust and moisture has always been a vexing problem.

A dust-proof wardrobe trunk recently invented offers a welcome solution of this problem. It consists of an inner case, the real trunk, which fits closely into a substantial outer case, which is fastened by bolts to the running-board of the automobile. One-half of the trunk is divided into drawers and compartments for hats, shoes, veils and lingerie. The other half has hangers to hold men's or women's garments so that they will not become wrinkled. The inner container has handles and can be taken out and carried to the owner's room, while the outer case remains in position on the car. While traveling the trunk is covered with a dust- and water-proof covering as an additional protection for the contents from the ravages of the elements.



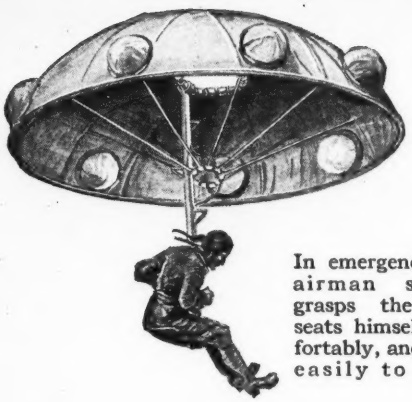
For travel-comfort and respectable appearance carry a wardrobe trunk on the car's running-board

Automatic Telephone System Invented by Undertaker

INVENTORS who have new ideas which are foreign to their vocations or lines of business may derive encouragement from the fact that the inventor of the first practical system of automatic telephony was Almon B. Strowger, of Kansas City, who took out a patent in 1889. The inventor of the Strowger system was an undertaker who was in no way connected with electrical engineering or with any telephone enterprise.

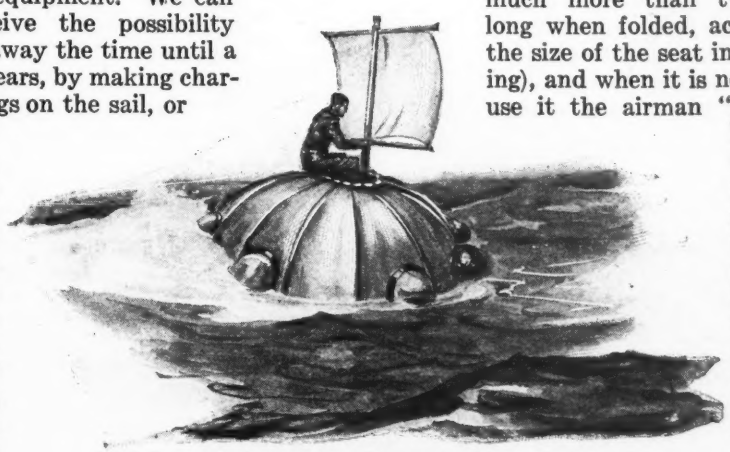
The Parachute de Luxe

This safety contrivance has almost all the conveniences of an up-to-date hotel



In emergency, the airman simply grasps the pole, seats himself comfortably, and drops easily to earth

WHY don't our War Department officials wake up? We present here for their serious consideration a recently invented parachute which provides all the conveniences of a hotel. It's a joy to trust one's life to that parachute, after a balloon has been shot to pieces or an airplane has become unmanageable. You have comfortable seating accommodation, facilities for swimming and bathing, a sail for yachting, and gymnastic equipment. We can even conceive the possibility of whiling away the time until a rescuer appears, by making charcoal drawings on the sail, or comfortably taking a sunbath on the exterior, or playing solitaire with the waterproof cards, the inventor having thoughtfully provided everything, including steps for the mast on the bear-pole principle, and access to the roof.



Alighting on the water after a perilous descent he hoists the sail and heads for home in a spanking breeze

Broadly considered, the parachute is a gigantic umbrella of fabric, properly stayed and arranged to open like a regular parachute. It has a hollow stem within which is a collapsible mast, carrying a sail that can be hoisted to different heights for navigating or signaling. The "handle" of the umbrella is a nice, comfortable tie-up seat, for the user's convenience. As the inventor innocently remarks, "he may rest with his body partly submerged if desired," thus, you will note, providing facilities for water sports. Around the edge of the umbrella top are a number of rubber fabric air receptacles, each of which has a funnel-shaped aperture on the lower edge, with a clap-valve in the neck, so that they will inflate with the rush through the air and will buoy up the apparatus if it should strike the water. Why does the water thoughtfully refrain from entering the clap-valve too? The inventor is silent on that point.

The machine is to be carried "in any convenient manner upon an aircraft," (there being much spare room on an airplane, and this apparatus could not be much more than twelve feet long when folded, according to the size of the seat in the drawing), and when it is necessary to use it the airman "grasps the lower part of the pole and adjusts himself on the seat." This, of course, is quite a simple operation; one merely has to emerge from the wreckage, grasp the pole, and jump out.

Having lightly floated down like a particle of thistledown, and alighted gracefully like a tired bird, the rest is simple, if he is on the ground; but if he is on the water, then the comforts of the parachute discover themselves. The aviator, feeling like a giant after his exhilarating flight and cold plunge, climbs up the pole and makes himself at home.

It takes a long time to make butter with this churn, but time is the one thing the women of Mt. Sinai have in abundance

Milk and Churn Are Both Supplied by the Goat

ABOUT seventy miles northwest of Mount Sinai—where, as you remember, Moses received the Commandments—is a butter factory, the machinery of which has not been improved since his day. It consists of a bag of goat skin suspended from a tripod of poles. The Bedouin women partly fill the bag with goat's milk and then have plenty of time to discuss the neighbors as they patiently rock the bag until the butter is separated from the whey.

Weld the Liberty Bell So It Can Speak for Victory

IT has been suggested that the Liberty Bell be welded with an oxyacetylene welding torch and rung when the Germans are beaten and the war is ended. Welding restores the tone of a bell completely, making it as melodious as when new. Welding should be done on the inside of the bell. There will be nothing to show it was ever cracked.

Making the Dirt Fly in Korea on the Tug-of-War Principle

WHEN they have an important excavating job on hand in Korea, the contractor doesn't have to wear out brain matter worrying over machinery to do the work. All he needs is a broad shovel with two holes through the blade, two stout ropes roved through the holes and plenty of man power to pull. That's the way the foundation work for the new post-office building in a suburb of Seoul, the capital of Korea, was started, and a glance at the picture will show you that the very best sort of training for a Korean contractor would be to serve as captain of a tug-o'-war team.

Since this is the first shovelful perhaps they are putting frills on the work, but twelve men to one medium sized shovel does seem a waste of power. Readers fond of statistics may figure out for themselves how long it would have taken to dig the Panama Canal with this kind of power: then they can calculate what we owe the man who set steam to work. Fortunately, labor is cheap in Korea and time not much of an object. At that they will probably finish the job while New York is still digging out its new subway.

Twelve men to one shovel! How long would it have taken to dig the Panama Canal on that principle?

The Horse of Joy—A New Outlet for Animal Spirits at Coney Island

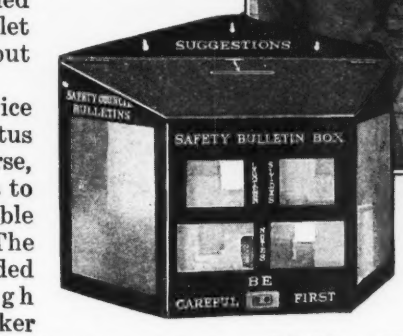
EXPRESS no surprise if the barkers at the amusement resorts plead, "Here you are, boys, lift a ton and suffocate; it's barrels of fun."

It will simply assure you that Otto Fritsche, a jovial citizen of Ulm, Minnesota, has succeeded in introducing a device which is intended to give you another outlet for your pent-up but exuberant spirits.

The amusement device consists of an apparatus made to look like a horse, the body of which is to be constructed of double walled aluminum. The horse of joy is provided with a door through which the merrymaker enters, his legs protruding from below the body. On the interior will be found a pair of shoulder straps, which will take the load off his head. A small gasoline motor drives the "horse" forward, and as it does the seeker of the blue-bird takes the necessary steps to maintain equilibrium. A periscope is provided which extends from the interior of the frolicsome equine out over its head.

Otto has ingeniously arranged to have the exhaust pipe of the gasoline engine run along the upper wall and out of the horse's ears. Doubtless, Otto wants the horse to appear very realistic and high spirited through its ears.

Aside from the fact that the contraption is supported in the rear by a pair of large wheels, that the front is supported by a human being, that a periscope protrudes from the head, and that exhaust gases puff from its ears, Otto believes it will be mistaken for a real animal. It might be on a dark night.



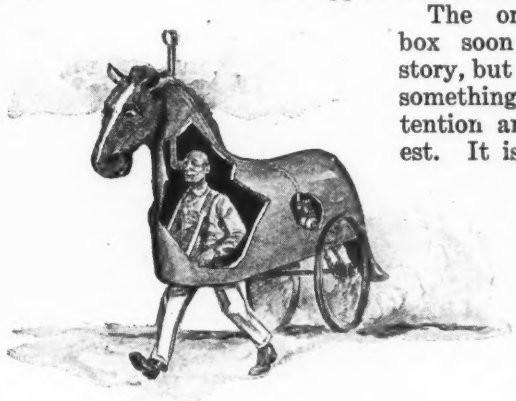
New devices have made this "question box" so interesting that it seldom lacks readers

Making Them Stop, Look, Heed, and Help

A SILENT but most efficient worker in the "safety first" campaign of the United Gas Improvement Company, of Philadelphia, is a box provided with a flashing light which throws into bold relief lantern slides that teach lessons of carefulness or display "horrible examples." The box is an adaptation of the ordinary suggestion box adopted by many large employers. It has spaces on the side for the display of letter-size bulletins as well as the lantern slides, and a slot in the top through which bright ideas may be dropped in written form.

The ordinary suggestion box soon becomes an old story, but this one always has something new to attract attention and stimulate interest. It is strongly made of light sheet metal and contains a flash lamp, double-glass slides, and a short section of insulated cable.

The box installed by this company more than paid for itself in a short time.



We would like to interview any man who has tried this form of amusement and has survived

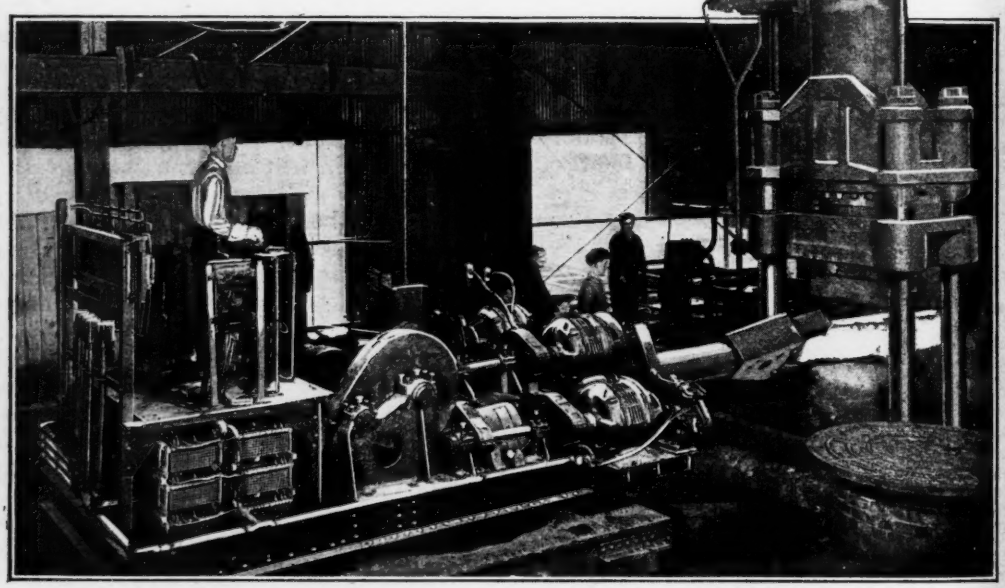
Handling Tons of Metal Like a Toy

A giant blacksmith of steel and iron
with a human brain in full control

DID you ever watch a blacksmith at work, forging a horseshoe or some other object of wrought iron or steel? With his tongs he draws the glowing metal from its bed of fire in the forge, and resting it upon the anvil he begins to hammer it into shape. His powerful arm turns, bends and twists to bring the hot metal in just the right position on the anvil.

In big steel works steel ingots weighing 2,000 or 3,000 pounds are forged under a gigantic drop hammer or in a hydraulic press. A blacksmith's arm has not the strength to handle such prodigious weight. For that reason human ingenuity has invented a machine, which is shown in the accompanying picture. It handles 3,000-pound steel ingots as easily as a blacksmith handles a few pounds of iron.

The manipulator, in the powerful jaws of which the ingots are held while they are forged, has five movements, provided by separate motors. The whole handling mechanism is mounted upon a revolving table or platform resting upon a truck. The truck runs on a six-foot gage track and has a forward and backward movement of eighteen feet. The jaw-operating arm has a diameter of about twelve inches and ends in jaws three feet long. The arm revolves and also has an up-and-down motion, like an elbow joint. The manipulator has two eleven-horse-power and three fifteen-horse-power motors for driving the operating mechanism. The man on the little platform, with his hand on the lever, controls every motion of the huge mechanism. He represents the brains of the blacksmith. The machine is his arm. By switches and wires, representing the nerves, the muscles of the arm, the motors, are set in action to execute the commands of the controlling brains.



The man on the platform is the brain of the blacksmith, the machine is his arm. With it he does the work which formerly required seven men

Tale of a Tub, for Which Supply Your Own Moral

THE man who put the bathtub where it appears in the picture is not a crank on open-air bathing. In fact, we hasten to appease Mrs. Grundy by announcing that the tub has been turned from its original purpose and made into a very efficient trough for horses.

Not a country substitute for a bathing beach, but only a bathtub put to unusual uses

But it wasn't thrift that put the bathtub on this job under the pump; quite the contrary. The man on whose place it stands has a fine artesian well, and he installed a force pump, intending to put water into his house. Anticipating this improvement, he bought a bathtub. Then he procrastinated and finally put the tub under the pump instead of in the bathroom, which is still without water, although several years have passed since the tub took temporary employment as a watering trough.

The Physical Sciences and the World War

ACCORDING to Dr. G. W. Crile, writing in the Pennsylvania Medical Journal, "The present war is a contest of ideas rather than of men. In its broad sense it is the practical application of physics, chemistry and biology in a mass struggle for the existence of nations."

Automobiles in the Philippines

IN the Philippines civilization is progressing slowly outside of Manila and some other centers of population. The accompanying picture shows one of the primitive ferries which cross the Sumag River. It is merely a big bamboo raft, unpretentious and crude, but it is evidently strong enough to ferry an automobile across the picturesque river. A rope is used to pull the raft from one side of the river to the other.

© Brown and Dawson

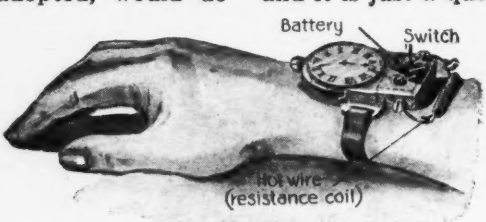
We wonder what they charge on the Sumag River in the Philippines to ferry you across on a bamboo raft. We should not mind paying anything if they would guarantee a safe landing

When the old barber's apron goes, you will be imprisoned in a kind of lampshade from which your curly locks protrude. The hair falls into a gutter

Hair-Cut? Yes?—Then Poke Your Head Through This Lampshade!

SCORES of inventions have been made and generally introduced by which the various beautifying operations usually performed in barber shops were made more satisfactory and less painful. But the bib or apron, that traditional concomitant of hair-cuts, has endured through centuries, in spite of its disgusting and unsanitary features. Now, at last, an Australian, Donald McLeod, of Lang Lang, Victoria, has made an invention which, if generally adopted, would do away with the ancient apron.

McLeod offers as a modern substitute for the apron a device shaped like a lampshade. It is made either of metallic segments or of one continuous piece of flexible material in the form of a truncated cone. The narrow part of the cone is fastened around the neck. The cone, resting on the shoulders, covers and protects the body from the falling hair. A gutter at the lower edge of the cone prevents the cuttings from sliding down the smooth surface of the cone, and falling upon the ground. The hair remains in the gutter and can be swept to a chute provided for the purpose and dropped into a receptacle. The inventor has provided several methods for fastening the cone, and as an additional sanitary feature he suggests the use of a fresh collar, attachable to the upper edge of the cone, for every patron.



A hot resistance coil burns into the flesh of your wrist the truth that it is time to get up and go about your duties

A Silent Alarm Wrist Watch That Burns the Sleeper

A SILENT alarm wrist watch has been designed with the object in view of waking a person without annoying the neighbors. If successfully attained, the object should be much appreciated in the average boarding house and is worthy of commendation. A current-heated wire about the wrist is supposed to scorch the sleeper sufficiently to make him open the switch, and he usually does so without wasting time in dreamland.

The necessary current is supplied by a miniature battery, also worn on the wrist, and a small switch lever is inserted in a space beneath the watch crystal opposite the predetermined hour. When the hour hand has reached the proper point it closes the switch and scorches the victim prone to oversleeping.

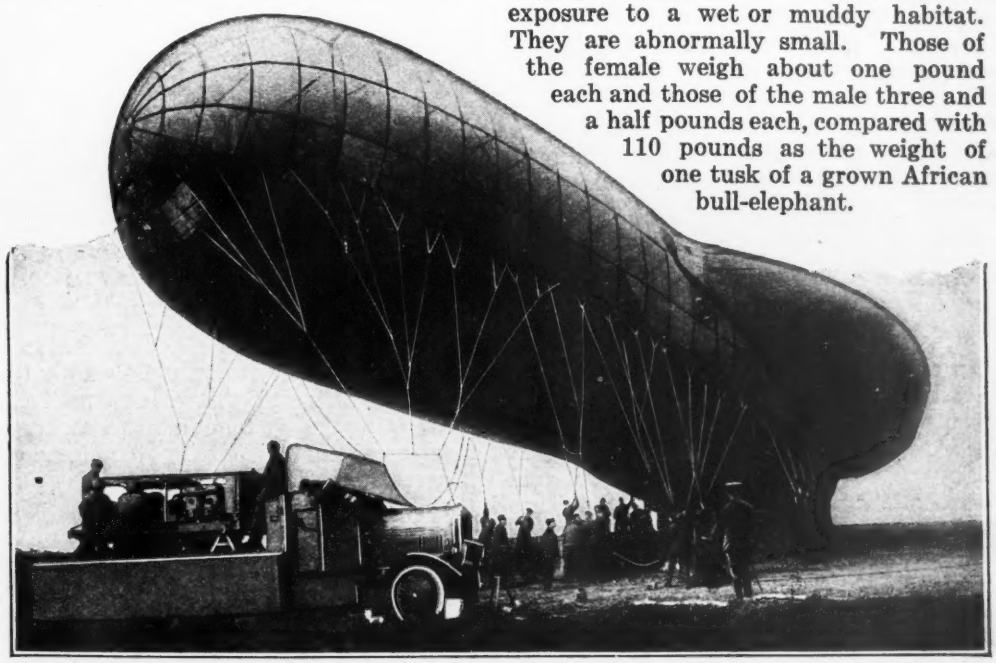
The alarm itself is undoubtedly silent, and it is just a question whether the yell emitted by the sleeper annoys the neighbors less than does the ordinary alarm clock.

However this wrist watch will prove invaluable at the battle front which demands heroic remedies for sleepiness.

It Takes Fifty Men to Transport an Observation Balloon

KITE balloons are used extensively in the present war on all fronts. Together with the numerous airplanes employed by both sides, they constitute the most important means for observation and fire control. Observation balloons are particularly useful in trench war, which, as a rule, means practical immobility of the lines for long periods. That does not mean that observation balloons cannot be used to advantage on marches. They can be used and are used even then, but only under the most favorable conditions.

Kite balloons are big and awkward to handle, require a great deal of apparatus with a correspondingly large force of men, and are difficult to transport in an inflated condition. One of the average-size observation balloons used on the West front requires a crew of at least forty-eight men; larger balloons even more. The park of a field balloon company consists of six gas wagons, one balloon wagon, one rope wagon, one requisition wagon, one ladder wagon, and two provision wagons. Formerly the wagons were drawn by horses, but in the present war motor-trucks are used almost exclusively for the heavy work of transporting the gas-making plant, the balloon itself, and the rope or cable drums. Observation balloons are used mainly to watch enemy movements back of the front line trenches; on which account, and to keep out of range of his anti-aircraft guns, they are sent up to high altitudes. There they are exposed to enemy airplane attacks, so that at all times aviators must be ready to fly up for its defence.

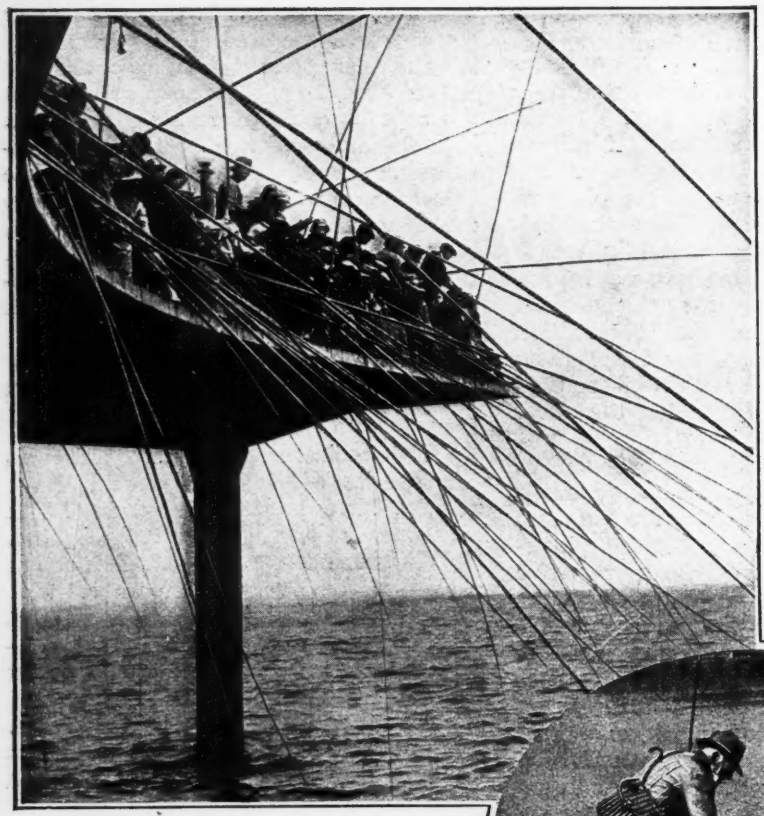


An average captive balloon requires a crew of at least forty-eight men. Six gas wagons, one balloon wagon, one rope wagon, and four supply and tool wagons constitute a balloon park

Look for the Pigmy Elephant When You Go to the Circus

TWO specimens of a hitherto unknown species of elephant, a real dwarf variety, have been captured in Africa and were recently taken to England. This is considered a most important zoological discovery, comparable with that of the okapi in the Congo forest several years ago. These pigmy elephants grow to be five and a half or six feet high; that is, half the height at the shoulder of an ordinary African elephant.

The tusks of the two dwarf elephants now in England are very dark, and display evidence of wear and tear and of exposure to a wet or muddy habitat. They are abnormally small. Those of the female weigh about one pound each and those of the male three and a half pounds each, compared with 110 pounds as the weight of one tusk of a grown African bull-elephant.



It was Izaak Walton who said sententiously that angling "begat habits of peace and patience in those that professed and practised it." That's true of your lone fisherman, Izaak, like the one pictured below, for instance. But what of the wrangling hundreds on a small city wharf? The crowd in the large picture was photographed while the mackerel were running along the California coast

A Fine Chance for Trouble Here When the Fish Begin to Bite

LOOK at the picture of the ocean pier, crowded to the limit with men and women fishing for mackerel. They may catch fish, perhaps tons of them. Is that sport? Lines become tangled, hooks fasten themselves to hats, clothing and skin of the fishermen, and the scorching sunlight, reflected also by the water, burns and blisters the skin, adding tortures to the discomforts and irritation of the sweltering crowd. Do you think you would enjoy that kind of fishing?

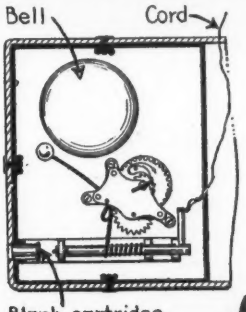
Now look at the other picture! It fairly breathes blissful quietude and peace. A pond or lake, framed by a dense growth of trees, clear water, a convenient pier and the assurance that the water is well stocked with the gamest kind of trout—what else could the lone fisherman wish to complete his contentment and happiness, unless it is to be spared the annoyance of unwelcome intruders?

One-Man Submarines Have Been Found Impracticable

"MANY hundreds of proposals," says a bulletin recently issued by the Navy Department, "have been received, advocating one-man submarines and submarines of small size, to be manufactured in great numbers for the purpose of attacking and destroying the larger type of enemy submarines. This subject has been given exhaustive consideration, and it has been conclusively proved that no small submarine can be provided with the necessary power, speed, equipment, and living quarters for the crew to enable it to operate successfully in the submarine zone."

A Shock for the Thief Who Steals This Bag

THE sneak-thief or hold-up man who snatches a bag or suit case equipped with the alarm device recently invented by Alexander Bull is likely to get the shock of his life. It's a simple device, which may be attached to any sort of bag or grip and which consists of a bell and blank cartridge alarm which are actuated by pulling on a string looped around the wrist.

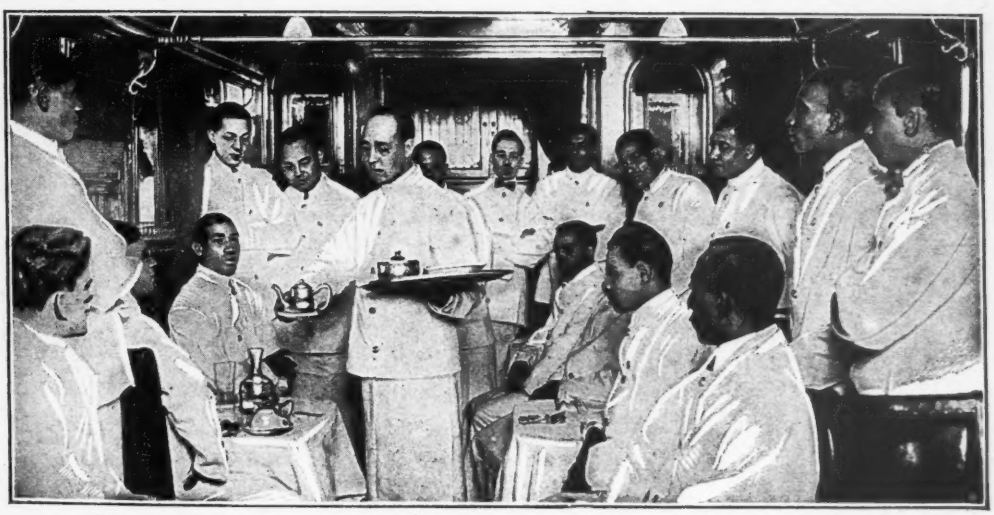


You guess correctly. The thief is trying to steal the bag. But it has a string to it

Imagine yourself the owner of Bull's burglar-foiling bag. You dispose within its interior your Liberty Bonds and your last week's pay and snap the lock. A thief attempts to snatch the bag. He pulls it. As he does so, the tightened string releases a trigger inside the bag which fires a blank cartridge. That ought to be enough. But Bull is thorough. He has provided an alarm bell run by clockwork, which is set off at the same time that the cartridge is fired and will ring continuously long enough to make it difficult for the thief to escape with his booty. Oh, yes; but what happens on a lonely street at three a. m.?

Teaching Waiters to Wait

THE traveling public patronizing the dining cars is fastidious and impatient and the waiters in these cars must be exceptionally efficient to satisfy the patrons. To maintain the highest degree of efficiency of service in their dining cars, one of the large western railroad corporations has established a school which all the waiters in their dining cars are required to attend. A fully equipped standard dining car has been set aside for the purpose. The classes are under the supervision of the old and experienced waiters who teach the raw recruits the art of serving. The accompanying picture shows the dining car school in session.

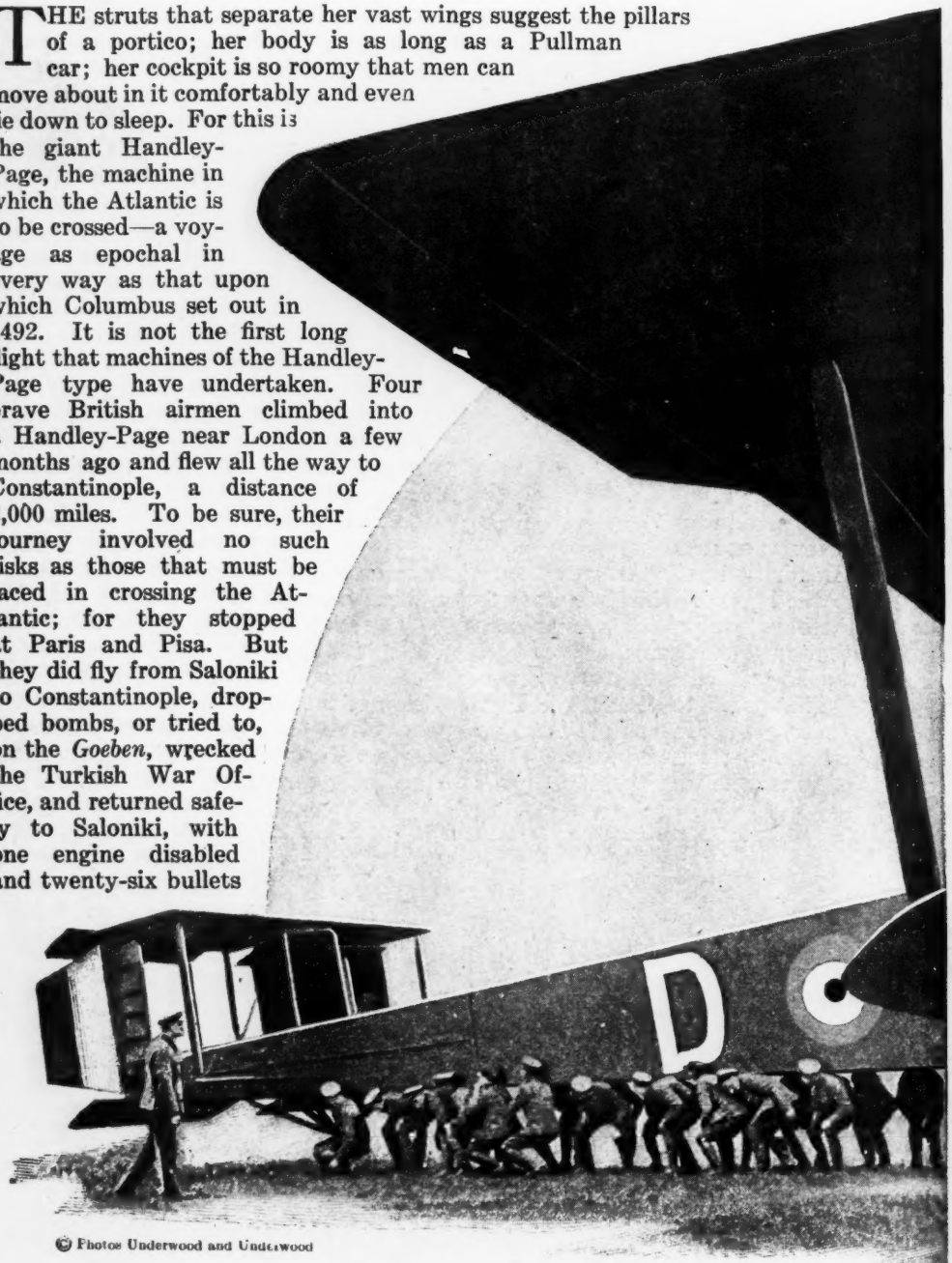


It seems that waiting is one of the fine arts. One of the large railroad corporations maintains a school in which dining-car waiters are taught how to wait

On Wings Across the Ocean to Fight

Giant bombing seaplanes which will travel to Europe in a day

THE struts that separate her vast wings suggest the pillars of a portico; her body is as long as a Pullman car; her cockpit is so roomy that men can move about in it comfortably and even lie down to sleep. For this is the giant Handley-Page, the machine in which the Atlantic is to be crossed—a voyage as epochal in every way as that upon which Columbus set out in 1492. It is not the first long flight that machines of the Handley-Page type have undertaken. Four brave British airmen climbed into a Handley-Page near London a few months ago and flew all the way to Constantinople, a distance of 2,000 miles. To be sure, their journey involved no such risks as those that must be faced in crossing the Atlantic; for they stopped at Paris and Pisa. But they did fly from Saloniki to Constantinople, dropped bombs, or tried to, on the *Goeben*, wrecked the Turkish War Office, and returned safely to Saloniki, with one engine disabled and twenty-six bullets



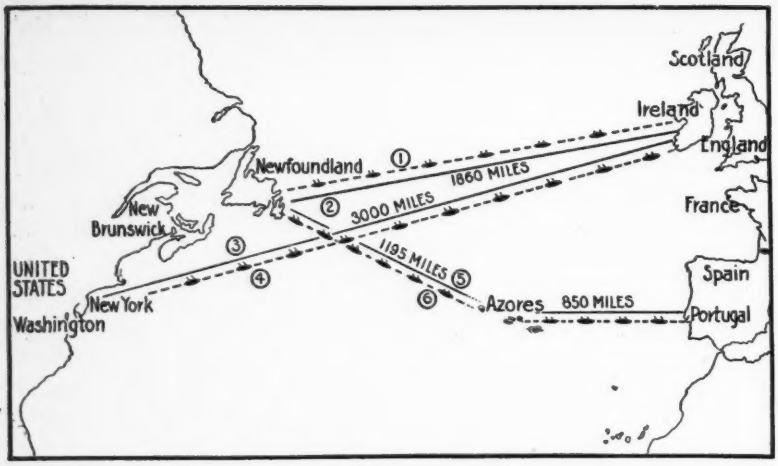
© Photos Underwood and Underwood

A great bird is the Handley-Page, which is to fly across the Atlantic. Her body, here held up by a company of men, is sixty-five feet long; her giant wings have a span of ninety-eight feet. She has two 12-cylinder Rolls-Royce engines

in their planes, after having covered six hundred and forty miles without a stop.

Now, the distance across the Atlantic is far greater than any seaplane, even the Handley-Page, has ever covered in a single stage. If the route to Portugal be taken and a stop made at the Azores—the route that seems to have most to commend it—a single flight of nearly twelve hundred miles must be made, to be followed by a shorter one of eight hundred and fifty to the Portuguese coast. The project is bold. Yet we have the assurance of no less an authority than General William Brancker, perhaps the best informed man on aviation in the British Army, not only that the transatlantic journey should be made, but that Handley-Pages built in this country should thus be delivered on the battlefield in an endless aerial caravan. What an exciting moment it will be when the great machine starts out on the first transatlantic voyage through the air. For days mechanics have tested each nut, bolt and screw, and plucked each wire, and listened to each engine as if it were a great beating heart. Then at last comes the supreme moment when the crew—four men eager to make history—don their fur-lined, leather clothes and strap on their helmets. Up a six-foot ladder they climb into the cockpit shortly before daybreak on that momentous morning. They seat themselves. The pilot waves his hand. There is a sputter and a roar as the two engines, housed in separate cars, are started. The mechanics step aside. For ten, twenty, a hundred yards

One of these machines recently made a record flight carrying twenty-one passengers. It has attained a height of over seven thousand feet



How to Get There on Wings

Route 1: The distance from Newfoundland to Ireland is 1860 miles. It could be covered in a seaplane which would be refueled every 300 miles from ships.

Route 2: If a land machine were used the distance from Newfoundland to Ireland would have to be covered in a single stage, which is possible now that such huge machines as the Handley-Page have been built, which can carry great quantities of fuel.

Route 3: Such is the fuel-carrying capacity of a Handley-Page or a Caproni that it could even fly the 3000 miles between New York and Ireland in a single stage; but it would have to be a land machine.

Route 4: A seaplane might be used to fly between New York and Ireland, the craft stopping every three hundred miles to take on fuel from ships.

Route 5: A machine could fly to Europe by way of the Azores. The distance of 1195 miles to the Azores could be covered in a single flight with a land machine. At the Azores the fuel tanks would be refilled and the craft would then fly to Portugal—850 miles.

Route 6: Seaplanes, taking on fuel from convenient ships, could fly to Europe by way of the Azores.

the machine runs over the water of Newfoundland—for she is a seaplane—dashing up spray as she moves on. Then the pilot gives her elevator ever so little an upward tilt, and she rises into the air like a huge seabird.

It is a gigantic machine indeed. The top plane measures ninety-eight feet from tip to tip. The length of the machine, including the tail, is sixty-five feet; its height twenty feet. The power is furnished by two twelve-cylinder "Rolls-Royce" engines of three hundred and seventy horse-power each. The fact that one of these machines made a record flight carrying twenty-one passengers and reaching a height of more than 7,000 feet gives an idea of its carrying capacity.

Of the four passengers, one is a navigator and one a mechanician; two are pilots. The pilots take turns at operating the craft; the mechanician keeps the machine oiled and in running order; and the navigator keeps the giant seaplane on its course.

Speed? Eighty-five miles an hour. But there is nearly always a twenty-mile current west to east, and the navigator availls himself of this when possible. Most of the flight is made at an altitude of about 5,000 feet. The men eat as the machine speeds on. They could sleep if they had any desire for sleep. But who could sleep? Besides, the journey to the Azores takes but seventeen hours.

Some time is lost by drifting, by the necessity of checking up location, especially after the sun goes down. But the instruments indicate the drift pretty accurately and keep the pilot on his course. The navigator works much as he would on board ship, except that his observations are less certain owing to the swiftness of the machine. Therefore, he makes good use of his wireless in getting his bearings as he nears his destination. When he sights a steamer, for example, he wirelesses her to get her location and other information. She flashes back the desired information. Knowing the steamer's position, he knows his own. He repeats this several times. He is also in communication with the great wireless stations in France, England, and the United States. A simple trigonometrical calculation based on their signals tells him where he is at any moment.

What's that ahead? The lofty Pico Alto, towering 7,500 feet above the Azores. The machine is 5,000 feet up. The pilot shuts off the engine. In another hour he glides down into the harbor. This first bombing-plane we have sent over has made the journey in less than a day. In another twelve hours the coast of Portugal is reached.

Suppose the machine had had to come down for repairs? Suppose there had

been a storm and the water had been rough?

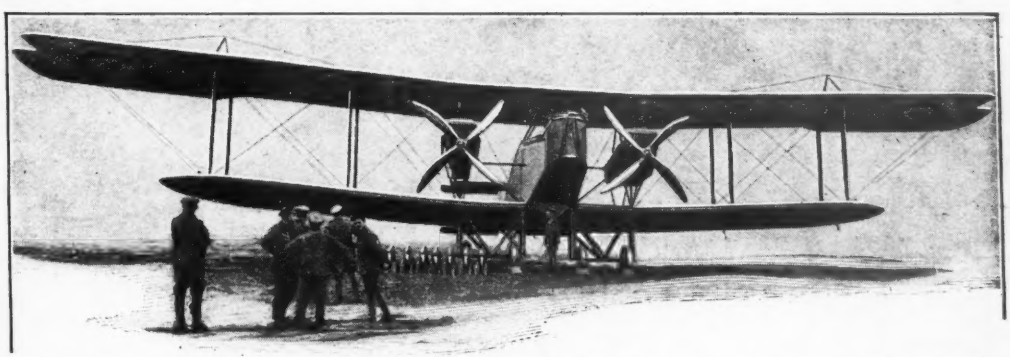
They might have drowned. For there is no possibility of rising in a seaplane from rough water. War is not a safe game under the best of circumstances. The man who flies across the ocean risks his life as much as the man who goes into battle. When you open your morning paper the day after the flight you will read comments on the difficulties encountered. Thus, one of the pilots will say:

"Meteorologic conditions were favorable, but we didn't worry much about this aspect of the flight. Military aviation has more and more outgrown the necessity of being dependent on meteorologic conditions. Only ten years ago an airplane couldn't fly if the wind blew. Now the warplanes fly through wind and a hail of bullets and shrapnel and keep on going after being hit as many as a hundred times. Lieutenant Colonel Rees of the Royal Flying Corps kept his machine going after it had been literally shot full of holes and after he himself had been shot through the leg and otherwise wounded.

"How much fuel did we carry? That was the least of our troubles. We calculated on one-tenth of a gallon per horsepower per hour. The machine had two 370-horse-power Rolls-Royce engines. That would make 1,295 gallons for the distance. This looks like a lot of weight, but these bombing-planes are specially designed to carry weight. They are weight-carriers and will be used to carry quantities of explosives, etc. On the flight over they use the space later to be given to explosives for excess fuel. We have never worried about fuel in making the flight."

And so a spectacular feat will give place to flight after flight across the ocean until the leaving of a plane from Newfoundland or New York attracts no more attention than the beginning of a steamer's trip for Liverpool. General Brancker sees no reason why the flying of heavy bombing-planes from America to Europe without wasting time or taking up much-needed ships' cargo space shouldn't be regarded as an eminently practical procedure. After the test flight, 10,000 of these bombing-planes are expected to go over as fast as they can be made ready for service. General Brancker believes that practically all the American weight-carrying machines will reach the battle zones by way of the air.

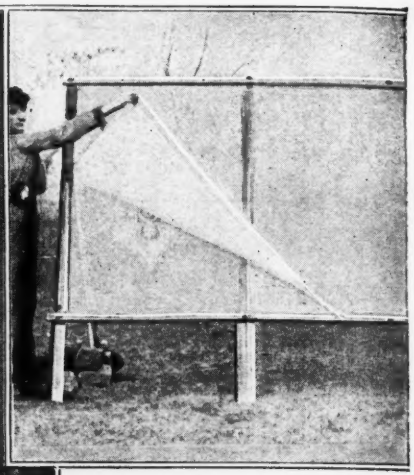
These giant planes will arrive at their destination a great deal lighter than they were when they started on their trans-atlantic voyage. They cannot carry bombs or any other war supplies because the large quantity of fuel they must have taxes their carrying power almost to the limit. Upon their arrival behind the fighting front they will be thoroughly overhauled and put into fighting trim. Then they will receive their full equipment of bombs and their guns will be mounted. After another try-out the monster machines will be ready to undertake long or short flights into the enemy's country, fully prepared to drop their big loads of explosives where they will do the greatest harm to the enemy. Each machine can carry approximately half a ton of explosives on each trip.



She will cross the Atlantic at a height of 5,000 feet and will land in Europe twenty or thirty hours after she leaves America. What an exciting moment it will be when she starts on the first trip!

Housekeeping Made Easy

Novelcigarettecase. When you pull out the drawer the mouse starts toward the figure

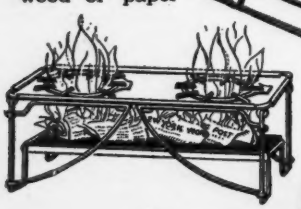


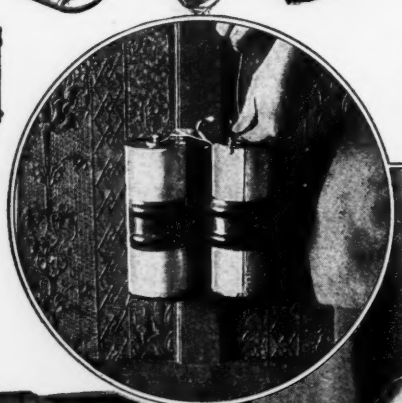
With this stretcher two or sizes may be stretched

The new liberty mop has a wringing attachment which takes the drudgery away from mopping

Folding camp stove with its fuel tray is shown below. It burns alcohol, wood or paper

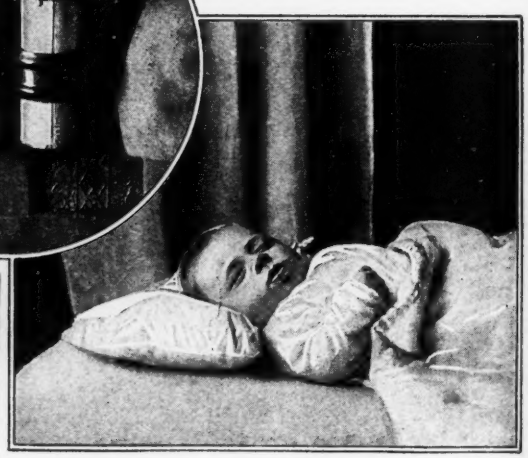
The skate and the basket used as bottle holders for serving cooling drinks





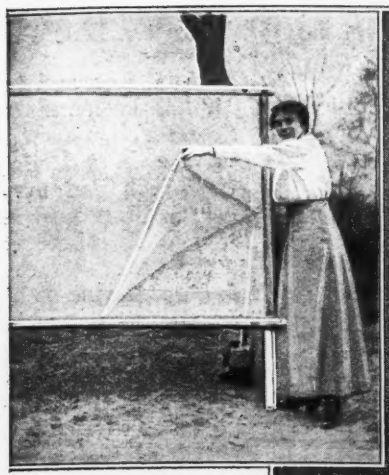
In the center circle is shown a metal bracket to hold two dry cells for the door-bell circuit

A combination desk that has a phonograph at one end



A special pillow stuffed with horsehair that has been rendered sanitary, for the purpose of making a cooling head support for the baby

Housekeeping Made Easy

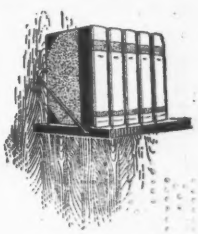


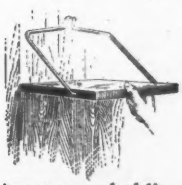
more curtains of various and dried at one time

The vacuum cleaner shown at the right is run by muscle power

A cone-shaped wringer. The corrugations catch and clean the mop as the handle is twisted

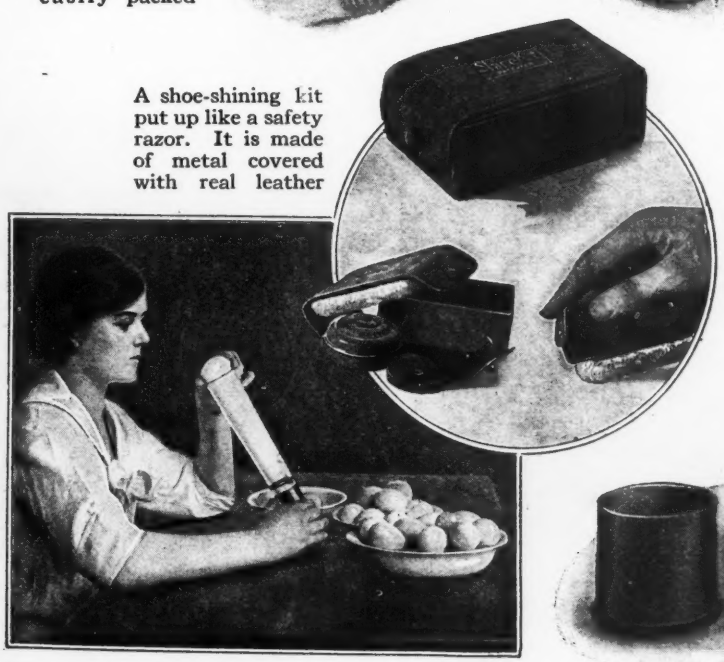
A knock-down tooth brush is shown at the right. It can be easily packed



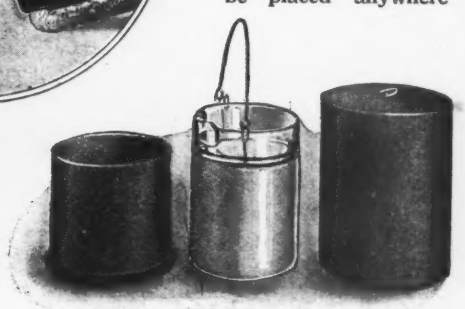


For temporary holding of books or a flower pot this portable shelf may be placed anywhere

A shoe-shining kit put up like a safety razor. It is made of metal covered with real leather



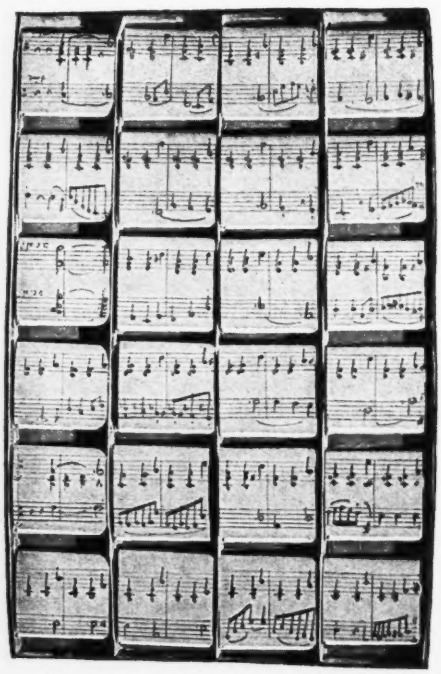
A tube made of cardboard rolled to fit the end of a flashlight for candling eggs



A water cooler consisting of glass jar, zinc cover and non-conductive casing

Turn a Knob and Become a Composer of Music

IT is possible for anyone to invent musical themes, provided he is able to read notes. A machine designed to aid in the composition of music and the playing of it as well has been invented by Arthur F. Blanchard, a member of the Massachusetts Legislature, in collaboration with Frank H. Grey, music composer.

The music machine resembles somewhat a sheet of music divided into small squares. There are six rows on each sheet, with four squares in a row and two bars of music in each square. Projecting from the sides of a box are the knobs of wooden spindles. Long strips of paper wide enough to contain two measures of music are wound about the spindles. In every section on each strip is a treble and a bass capable of harmonically uniting with any section immediately adjoining. As the paper strips are rolled and unrolled by turning the knobs on the spindles, the various sections are projected to the surface of the box as new squares.

This device enables the untrained person to compose and can his own music

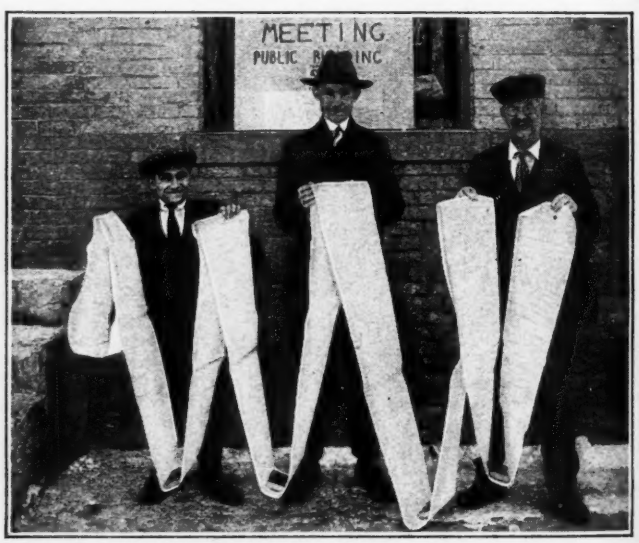
The device may be placed on the rack of a piano as if it were a sheet of music. The player has only to turn a knob to obtain the various combinations of melody. The composing can be completed by copying the notes.

No guarantee that anyone can compose an opera like the famous "Merry Widow," or even "Il Trovatore," goes with this music machine.

A Letter More Than Thirty-Eight Feet Long Without a Blot

A LETTER thirty-eight feet and ten inches in length has been sent to Frank Vaillancourt, a private in Company L, 104th Infantry, now in France, by his friends in Chicopee, Mass. More than fifty persons contributed to the letter, which was written in English, French and German. The German part was written by a native of Alsace Lorraine, who is now a loyal American. There was considerable variation in the handwriting, but the letter had no blots, although it was written in ink.

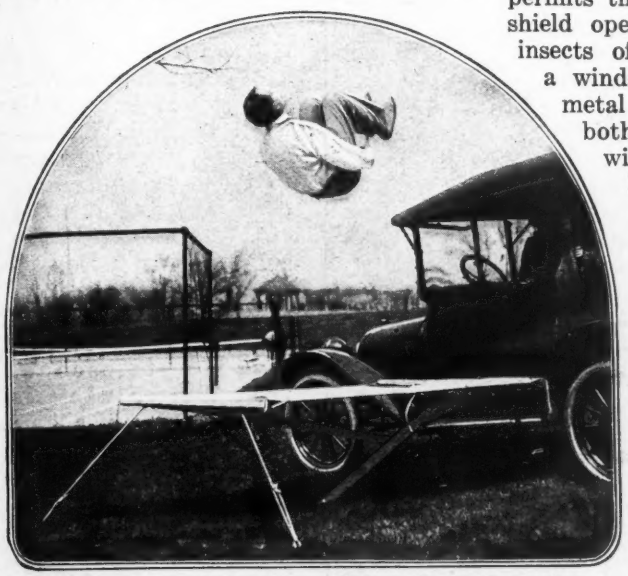
It is safe to say that the chronicle of home news and gossip of the town of Chicopee was completely exhausted to supply the material for this letter to its son in France.



It was a long, long letter that his fellow-townsmen sent to Frank Vaillancourt, serving with the colors in France

Discovered—A Cot that Doesn't Sag in the Middle

SLEEPING on a cot is an experience not likely to be enumerated among the pleasures of life. You lie down tired, and wake up next morning, if you have slept at all, more tired than ever. What's wrong? The cots. They sag in the middle when you lie upon them.



The inventor proves his confidence in his invention by turning a somersault on it from the roof of the car

But not all cots are that way. One has recently been invented that is unique. The heavier you are the less it sags.

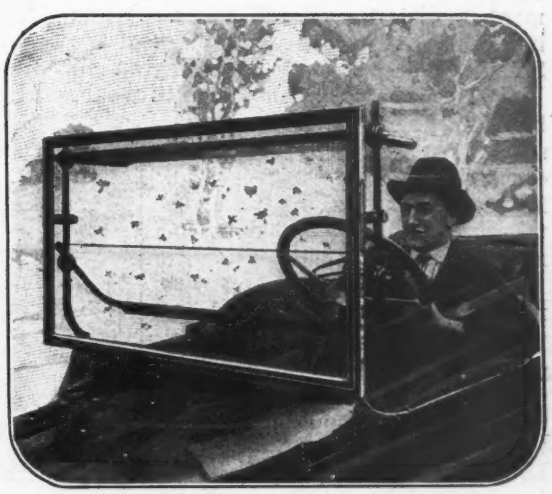
This remarkable cot, which is made in sizes to accommodate from one to six persons of average size, is intended as a portable tent bed for the use of automobile tourists. It can be folded up or put up in a few minutes, and is packed in a waterproof carrying case when not in use. The total weight of the complete outfit—tent, bed, and carrying case—is only ten pounds for each person accommodated.

The tent bed is put up against the side of the automobile, and is held down by ropes fastened to pegs driven into the ground, like the walls of a tent. The bed rests upon compound levers. The more you weigh, the more the canvas stretches.

Mosquito Bar for the Automobile to Keep the Bugs Away

A PRACTICAL new automobile accessory is a windshield screen which permits the motorist to keep his windshield open and still be protected from insects of all kinds. The device is a window-screen set in a wood or metal frame, which is attached at both ends to the uprights of the windshield.

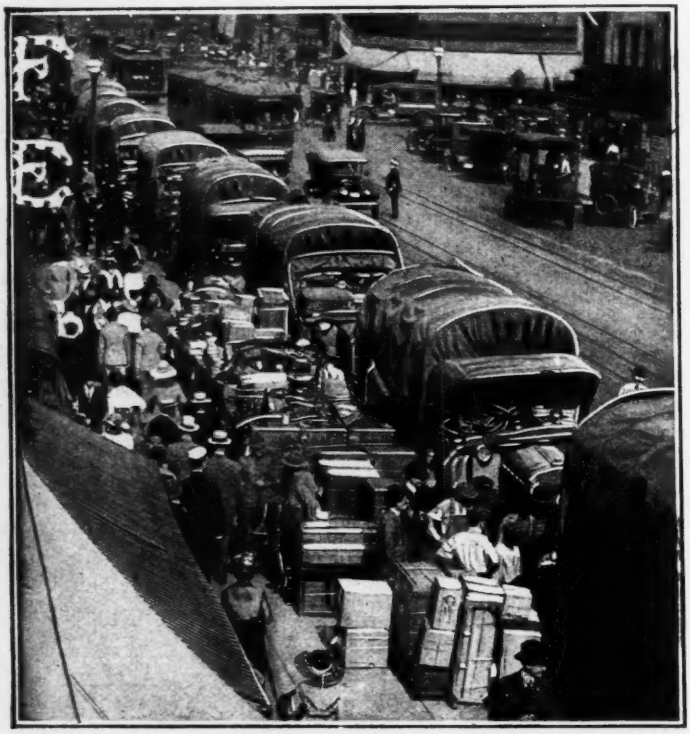
Besides protecting the eyes of the driver from flying insects that would otherwise pass through an open windshield, the screen serves to keep the driver cool on warm summer days and to prevent the air suction in the rear seat when the windshield is closed. The screen also serves to diffuse the rays of the headlights of automobiles passing in the opposite direction at night, since the fine mesh of the screen breaks up the direct rays when the lights are not dimmed, as on country roads. The use of the screen makes it unnecessary to wear goggles, which, even when well fitted, are uncomfortable on a warm day or night. The advantages of such a screen are so obvious that, ere long, no motorist will go on tour without one.



At the same time you are protecting your eyes you can be adding to your bug collection

Moving Day for the Shipping Board Made Easy by Motor-Trucks

RECENTLY motor-trucks were employed to move the entire office equipment of one branch of the government a distance of 167 miles. When it was decided to move the office of the Shipping Board from Washington to Philadelphia, so that the workers would be near the center of the actual shipbuilding along the Atlantic coast, it was found that by the fastest railroad freight it would take from four to eight days to move the office equipment.



Some of the hundred and forty motor-trucks loading up for one of their trips between Washington and Philadelphia

Therefore, 140 of the army's new standardized three-ton war trucks, which on good roads can safely carry five tons, were called into service. They made each trip, carrying six hundred tons, in less than twenty-four hours, including the time of loading at Washington and unloading at Philadelphia.

Give a Spy-Glass and Help Sink a German Submarine

A PERISCOPE can hide as coyly as a periwinkle (though why periwinkles are coy we do not know), and something more than the naked eye is needed when you go hunting the U-boat. That is one reason why, when we began to turn out submarine-chasers by the mile and cut them off in lengths to suit, the Navy Department at Washington asked everybody to send in his, or her, pet spy-glass, telescope, field-glass, or whatever they had that might be useful in peering for periscopes. Another reason for the appeal is that the mark "Made in Germany" is on most of the better grade of field-glasses—the making of them before the war being almost a German monopoly. We are making better glasses all the time now, but the submarine-hunters can't wait, and so that "Made in Germany" glass of yours is needed if it is a good one.

The response to the Navy's call was first made last October. To date, the Naval Observatory at Washington has

Experts at the Naval Observatory testing glasses to see if they are fit for U-boat hunters

accepted for use 31,000 glasses, and has returned 13,200 as unfit for use.

If you want to get your glass back, label it with your name and address. The department now has on hand more than a thousand unidentified glasses awaiting claimants.

Some of the glasses sent in are of great historic interest. One pair was used by General Grant at the Battle of the Wilderness; another, used on the Constellation in 1815, is still serviceable; and still another pair was the property of Captain W. T. Turner, commander of the *Lusitania* when she was torpedoed.

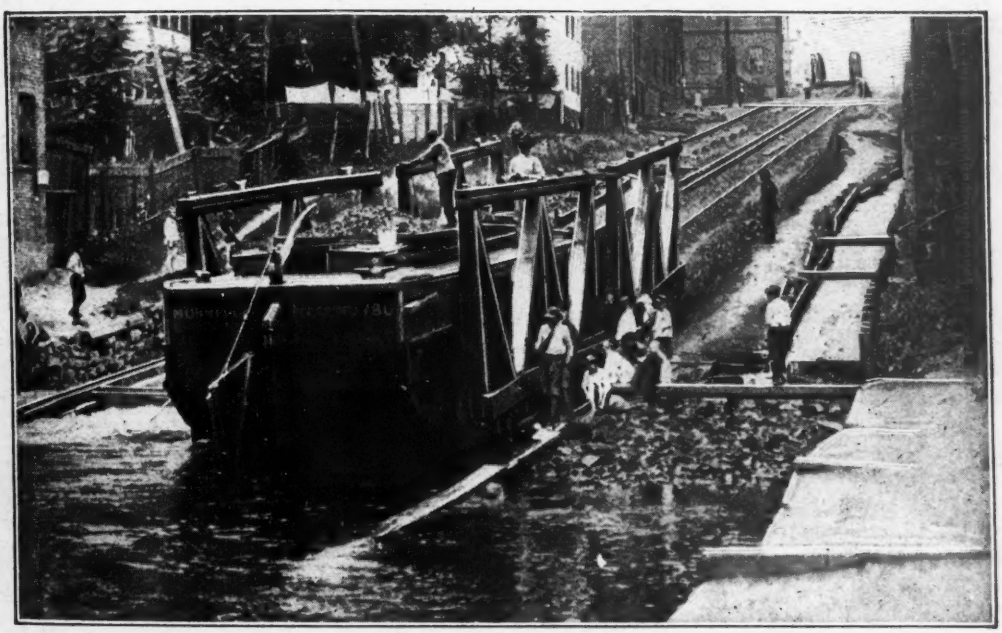
Canal-Boats that Climb Hills, and How They Do It

THE Morris Canal, which begins at Jersey City, winds its way leisurely through the State of New Jersey until it reaches Phillipsburg on the Delaware, where it connects with the Lehigh Canal system of Pennsylvania. The canal was opened in 1836, and was at one time a fairly important waterway for the transportation of coal from the Pennsylvania coal-fields. In recent years it was almost abandoned, but its use has recently been revived for carrying coal.

The Morris Canal derives its water from Lake Hopatcong. It is, without its feeders and branches, 102.38 miles long, and the highest point it reaches is 928 feet above sea-level. But in New Jersey also the water refuses to run up-hill, and to make it possible to reach the high level the canal is built in steps.

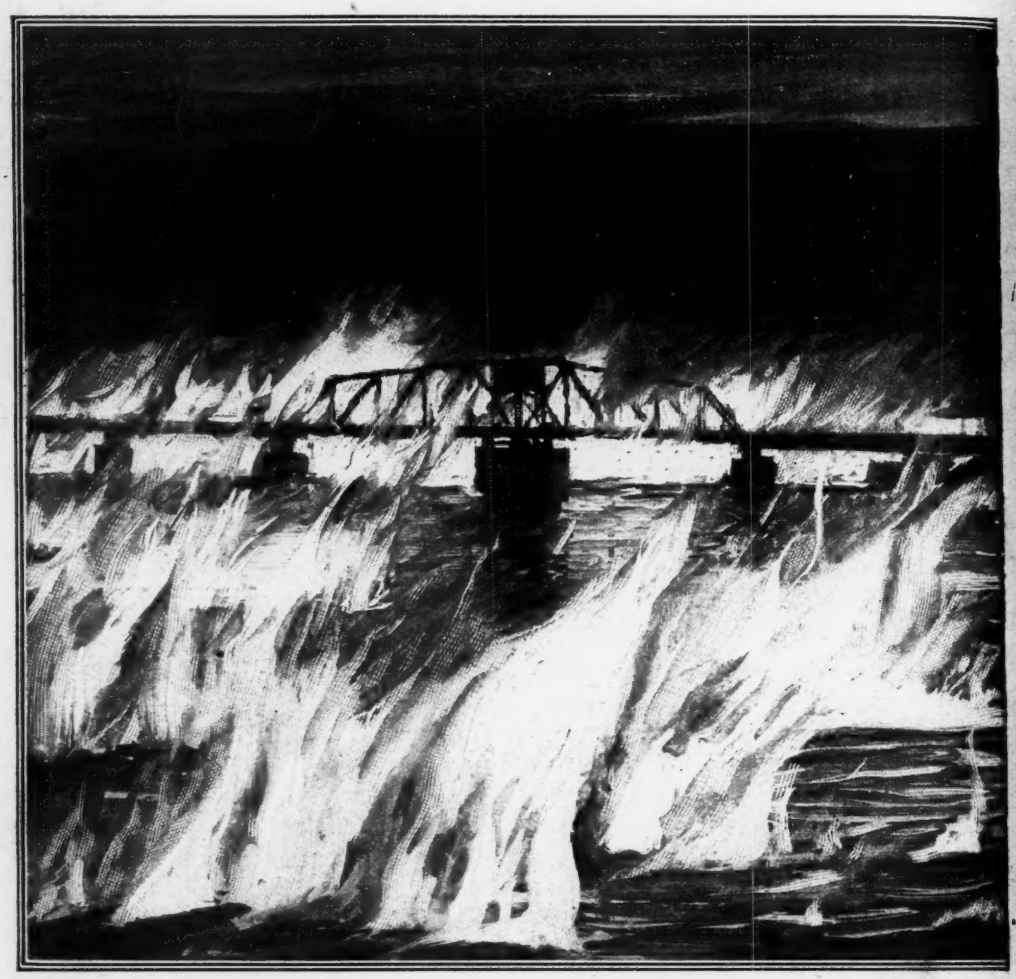
In order that the canal-boats may get from one level to another, inclined planes with cradle trucks on wheels are used. The cradle truck is allowed to run down into the water far enough to permit the canal-boat to float into the cradle. The cradle truck, carrying the canal-boat, is then pulled up the incline to the higher level, or lowered to the lower level down the incline, by means of a cable operated by a steam-winch. This primitive method was adopted, when the canal was built, at the suggestion of Professor James Renwick, then of Columbia College.

In the eastern division of the canal there are twelve such inclines, seven of them in Newark, which raise the boats about 720 feet; in the western division there are eleven inclines, which lower the boats about 690 feet. To overcome the rest of the grade, locks are used. The inclined plane shown in the picture is in the heart of Newark.



Since water refuses to run up-hill, the boats in the Morris Canal are carried up and down on cradle trucks drawn by a steel cable that is operated by a steam-winch

Great Fortunes Are Thrown



Water, water all around, and yet the fire burns. Waste matter covers the Passaic River with a film of oil that needs only a carelessly dropped match to turn it into a river of flame

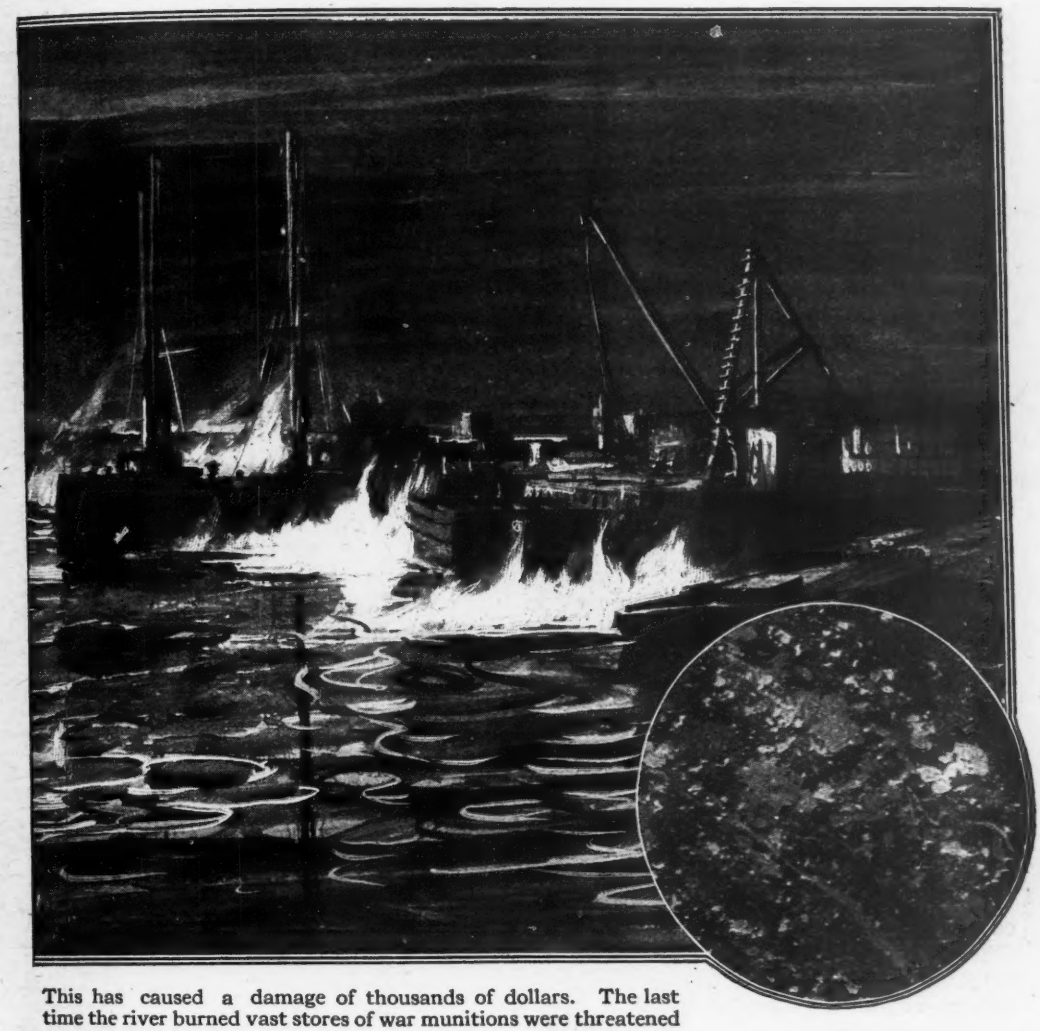
PRODIGAL RIVER runs through the Land of Waste and empties into the Bay of Squander. Whenever its castaway riches of chemicals, gases, oils, and gums catch fire, its economic sin is proclaimed throughout the country.

The last spendthrift carnival occurred not very long ago, when someone set fire to this stream of extravagance—the Passaic River. Where the fire originated, the water is still covered with an iridescent inflammable scum. This coating is made up of refuse from petroleum refineries at Bayonne, which is borne in on the tide to mingle with the greasy discharge from Newark, Paterson, Passaic, and other industrial communities of the valley. On the river drift waxen floes of paraffin. Along shore the piers and piles reek with the strong smell of crude oils, and the rocks are slippery and stained from the wastage of rendering-tanks. The gas plants of the cities contribute their quota in coal-tar and liquors charged with chemicals, while every factory releases polluting waste products.

Millions Lost in Silk Industry Alone

A persistent contributor to these foul deposits is the city of Paterson, center of the silk industry of the United States. The coloring from one pound of silk will spoil

Away on River that Burns



This has caused a damage of thousands of dollars. The last time the river burned vast stores of war munitions were threatened

Not a study of the Milky Way, but a "close-up" of the Passaic River. The spots and blotches are waste products representing an enormous fortune

a thousand gallons of water and inflict 2.05 pounds of solid waste upon the ever-patient Passaic.

The composition of these wastes was carefully investigated, not long since, by Dr. George C. Whipple, of Harvard University, who was retained by the Committee on Sewage Disposal of the city of Paterson. From 25 to 35 per cent of the weight of raw silk is a gum that must be washed away before the fibers are twisted and wound in the operation known as silk-throwing. This gum contains about 17 per cent of nitrogen, which could undoubtedly be utilized for many purposes. The throwsters, in cleaning the silken threads, use at least 5 per cent of the weight of the fibers in soap—the latter containing at least 60 per cent of refined vegetable oils. Making allowances for those manufacturers who recover at least 75 per cent of this soap, the amount of soap daily wasted by the dye-works of Paterson is 13,300 pounds, of which 8,000 pounds represent fat.

Scores of the products of the laboratory are employed in giving the varied shades to the fabric of fashion and luxury.

Some manufacturers use their dye-baths over and over, adding new coloring from time to time to keep up the strength. Logwood and the anilines are the chief constituents of the contents of the vats.

The tinge of the Passaic is largely due to the presence of discarded sulphur black thrown out of solution, although at times the sewage from Paterson has a purple or violet color when an unusual amount of expensive coal-tar products has been permitted to escape. The mills were glad to pay a dollar a pound for sulphur black not so many months ago, and at the present writing dyes in fancy colors are quoted at from eight to nine dollars. Undoubtedly millions of dollars have been lost from the waste of silk factories alone.

Wastes Now Being Eliminated

Pressure of legislation, State and Federal, has made the captains of industry along Prodigal River and all other waterways see new light on an old problem. They are now realizing that they have been wasting their substance in riotous living. Coincident with the investigation to determine whether or not there shall be inserted a clause in the Rivers and Harbors Bill excluding the discharge of free acids from all navigable streams above tide-water, the chemical-makers are finding that hydrochloric acid can be combined with lime and turned into a valuable disinfectant. Paper manufacturers are saving their sludge and selling a score of by-products derived from it.

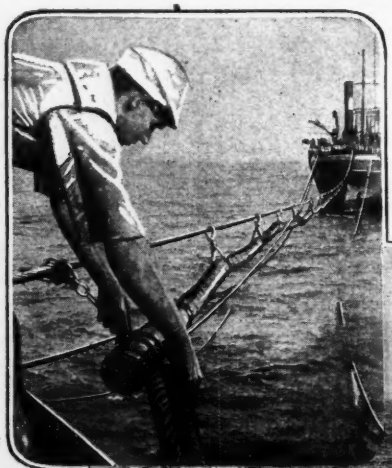
Even the municipalities, so often beholden to nobody, are reaping profits by turning into the streams a treated sewage clear as crystal, divested of a garbage grease worth fifteen cents a pound at war prices. The new trunk-line sewer that is to empty in New York harbor is estimated to cost $11,000,000. This could be met in fifteen or twenty years from soap waste alone.

Piping Oil from One Pitching Ship to Another at Sea

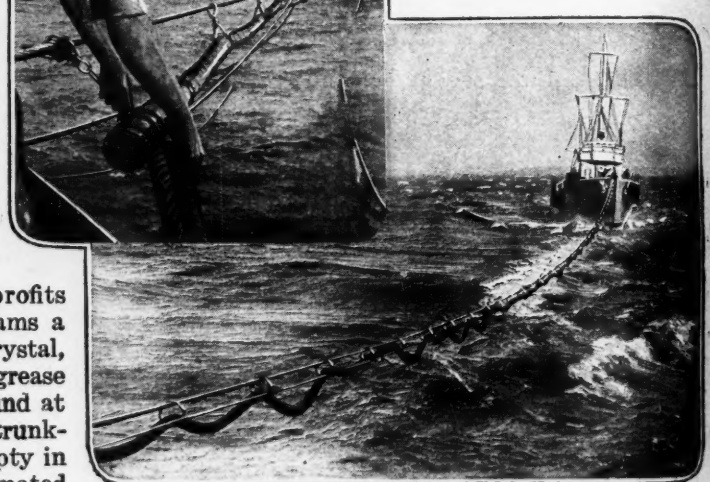
THE bunkering of sufficient fuel is a serious problem for ships of comparatively small tonnage starting on long cruises. Under war conditions, it becomes necessary to supply the ship with fuel from another ship at sea.

Transferring fuel from one ship to another while both are on the high sea has been a difficult problem to solve. To convey the fuel in bags or barrels by means of a cableway suggested itself; but it was found that this plan was not feasible when both ships were pitching in a heavy sea.

The success of the cableway method was made possible by the invention of the automatic tension engine patented by Mr. Spencer Miller, a noted American engineer. This engine maintains a constant pull on the steel cable connecting ships; it winds the slack upon a drum, and pays out more cable when the pitching of the ships, which are kept at a safe distance of 400 feet, increases the tension.

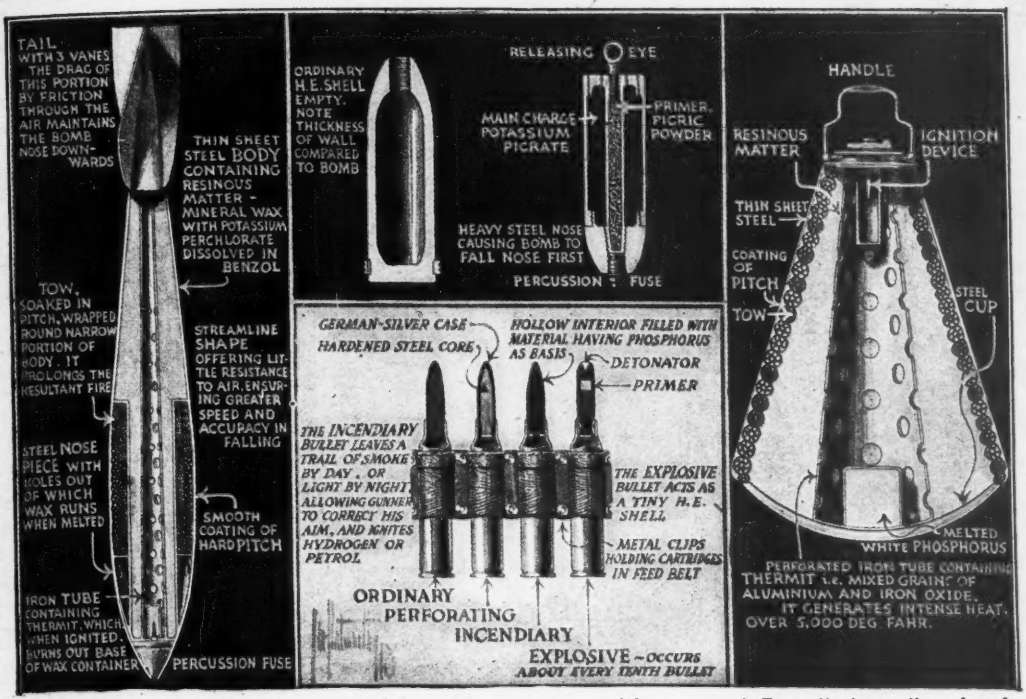


Taking on board the hose through which the destroyer is to get fuel for its engines in mid-ocean



Feeding time for the destroyer, which, being a bottle baby, is getting its ration of oil through a hose stretched along a cable to the mother ship. The cable also tows the destroyer, automatically giving or taking up slack

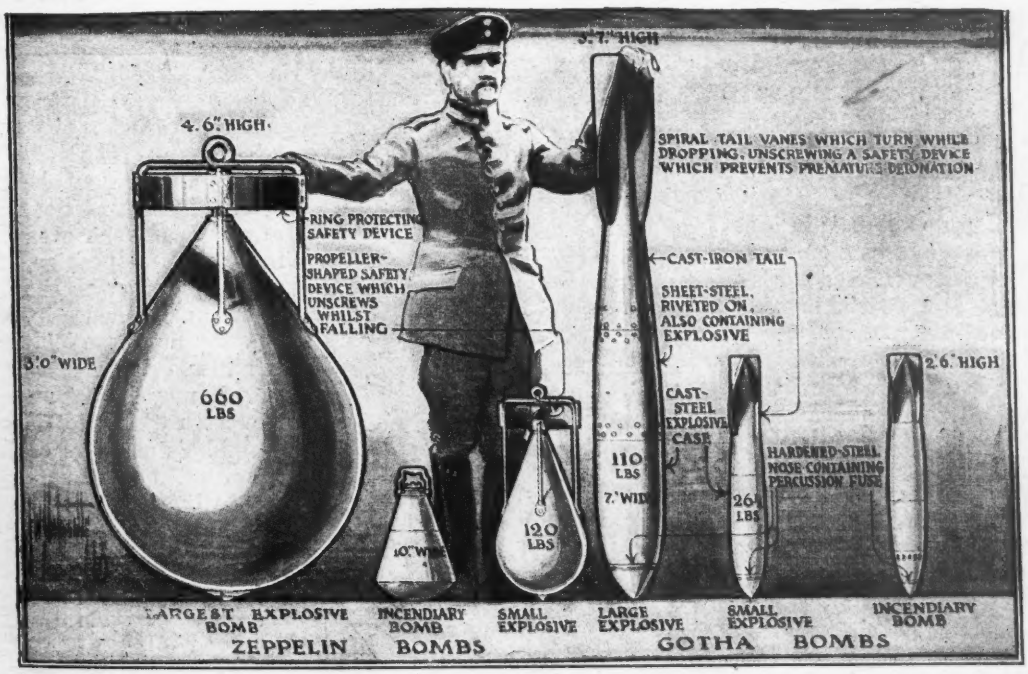
The Death that Drops from the Skies


TAIL WITH 3 VANES THE DRAG OF THIS PORTION BY FRICTION THROUGH THE AIR MAINTAINS THE BOMB NOSE DOWN-WARDS
THIN SHEET STEEL BODY CONTAINING RESINOUS MATTER - MINERAL WAX WITH POTASSIUM PERCHLORATE DISSOLVED IN BENZOL
TOW, SOAKED IN PITCH, WRAPPED ROUND NARROW PORTION OF BODY. IT PROLONGS THE RESULTANT FIRE
STREAMLINE SHAPE OFFERING LITTLE RESISTANCE TO AIR, ENSURING GREATER SPEED AND ACCURACY IN FALLING
STEEL NOSE PIECE WITH HOLES OUT OF WHICH WAX RUNS WHEN MELTED
SMOOTH COATING OF HARD PITCH
IRON TUBE CONTAINING THERMIT, WHICH WHEN IGNITED, BURNS OUT BASE OF WAX CONTAINER
PERCUSSION FUSE
ORDINARY H.E. SHELL EMPTY. NOTE THICKNESS OF WALL COMPARED TO BOMB
RELEASING EYE
MAIN CHARGE POTASSIUM PICRATE
PRIMER, PICRIC POWDER
HEAVY STEEL NOSE CAUSING BOMB TO FALL NOSE FIRST
PERCUSSION FUSE
GERMAN-SILVER CASE
HARDENED STEEL CORE
HOLLOW INTERIOR FILLED WITH MATERIAL HAVING PHOSPHORUS AS BASIS
DETONATOR
PRIMER
THE INCENDIARY BULLET LEAVES A TRAIL OF SMOKE BY DAY, OR LIGHT BY NIGHT ALLOWING GUNNER TO CORRECT HIS AIM, AND IGNITES HYDROGEN OR PETROL
THE EXPLOSIVE BULLET ACTS AS A TINY H.E. SHELL
METAL CLIPS HOLDING CARTRIDGES IN FEED BELT
ORDINARY
PERFORATING
INCENDIARY
EXPLOSIVE - OCCURS ABOUT EVERY TENTH BULLET
HANDLE
RESINOUS MATTER
IGNITION DEVICE
THIN SHEET STEEL
COATING OF PITCH
TOW
STEEL CUP
MELTED WHITE PHOSPHORUS
PERFORATED IRON TUBE CONTAINING THERMIT i.e. MIXED GRAINS OF ALUMINIUM AND IRON OXIDE. IT GENERATES INTENSE HEAT. OVER 5,000 DEG FAHR.

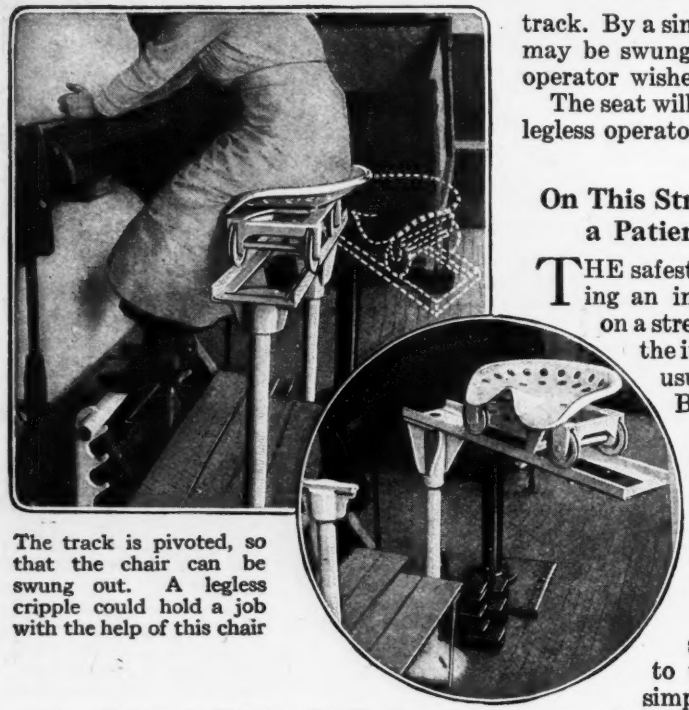
A Gotha incendiary bomb

Aerial machine-gun ammunition
Above—an explosive bomb of early type

A Zeppelin incendiary bomb



"There was another air raid on London last night." What that familiar announcement means may be read in these pictures, which show every type of bomb and bullet that is being used by the Germans. Do not be misled by the appearance of the propeller-like tails. There is no such thing as an "aerial torpedo." All bombs merely fall through the air; none has been invented that is self-propelling



The track is pivoted, so that the chair can be swung out. A legless cripple could hold a job with the help of this chair

The Sliding Chair—It Reduces Fatigue in the Factory

LONG before the true interrelations between economy and efficiency were generally understood, some pioneers in scientific management reached several important conclusions. They found, among other things, that it is in the interest of economy or efficiency to keep workers and machinery in the best possible condition.

Mr. R. C. Marshall, of Troy, N. Y., has recently invented and placed on the market the fatigue-eliminating seat shown in the pictures above.

The seat is specially intended for inspectors in paper and cloth mills. It is so shaped as to insure a normal posture of the sitter. It slides from side to side on wheels running on a track. By a single motion, seat and track may be swung out of the way when the operator wishes to stand.

The seat will make it possible to employ legless operators for inspection work.

On This Stretcher You Can Carry a Patient in Any Position

THE safest and best way of transporting an injured man is to carry him on a stretcher. The stretcher, with the injured man resting on it, is usually carried horizontally, But suppose space is limited—a narrow passage, for instance? It is just this situation that is met in an invention introduced by Dr. F. E. Clough, chief surgeon of a mining company in Lead, S. D. He has devised a stretcher especially adapted to use in mines. It is very simple, and has demonstrated its merits so satisfactorily that it has won the approval of the United States Government.

The patient is strapped to the narrow stretcher around the chest, hips, below the knees, and around the feet, with his feet firmly resting against a footboard. The loaded stretcher may be carried in any position, at any angle, and even in a vertical position, without danger to the injured man; hence its adaptability especially in mines.

It may be set up against the side of the hoisting cage or hoisted to the surface by a rope and pulley.

A new kind of stretcher for use in mines. Without the patient it looks like an ironing-board with straps and a footboard. It has handles at the sides and head end

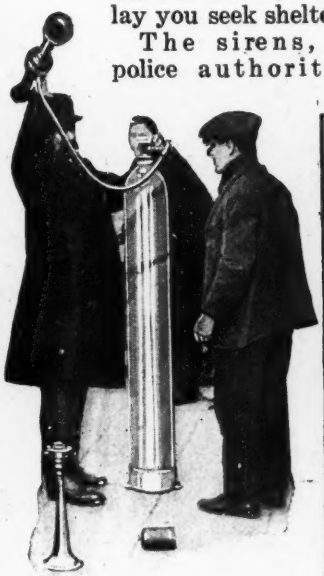
Big Sirens to Warn New York of Air Raiders

IT may never happen, but an attack on the Atlantic coast cities by hostile air raiders is by no means impossible. The military authorities have provided means of defence that are believed to be adequate, and the municipal authorities are furnishing means of warning the people of the approach of air raiders.

Imagine yourself in New York on a fateful day which, let us hope, will never come. You may be in your home, in church, in one of the sky-scraping office buildings, or on the street. Your thoughts are far from air raids. Suddenly you stop. A shriek, unearthly and indefinable, fills the air. You know what it means, and without delay you seek shelter.

The sirens, which the police authorities of New York have placed on the roofs of buildings throughout the city, are of the electrical type. They are wired in series, so that, by throwing in a controlling switch, all of them are set going at the same time. An electric motor, driven by alternating or direct current, rotates two cylinders at the rate of 3,500 revolutions a minute within perforated sleeves. The shrieking sound is produced by the vibrations of the air passing through the perforations in the rotating cylinders, as the holes move past the holes in the sleeves surrounding the cylinders. The greater the speed, the higher the pitch of the sound. The shriek of these sirens can be heard a distance of three miles if the conditions are favorable.

New York sirens produce sound with air passing through perforations in fast rotating cylinders

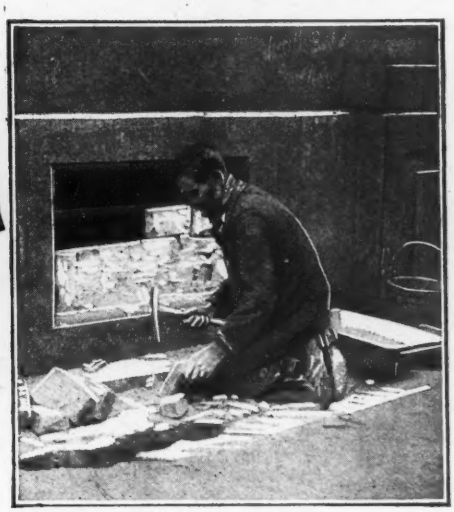


In Paris, sirens connected with compressed-air tanks are used; they are placed at the street corners

Paris Is Now Making Even Its Cellars Bomb-Proof

WHETHER it be a cyclone or a bombing raid, the safest place in time of danger from the air is the cellar. So, when the siren shrieks its warning in Paris, the people seek safety underground.

Once in a while, however, a shell bursts just outside and death-dealing pieces rain through the cellar windows. Therefore, orders have been issued to bank the windows with sand-bags—orders that the Paris police make sure are carried out. The man in the picture is substituting a sturdy stone barricade for the sand.



© International Film

Stone walls do not a prison make, but they'll help keep bursting bombs out

Diving for Millions in a Giant Bell

After the war there will be a rush for the fortunes lying in torpedoed ships at the bottom of the sea

DO you want a fortune that would make John D. Rockefeller jealous? It's easy. Just invent a sure means of raising the great fleet of torpedoed ships that lie in comparatively shallow water.

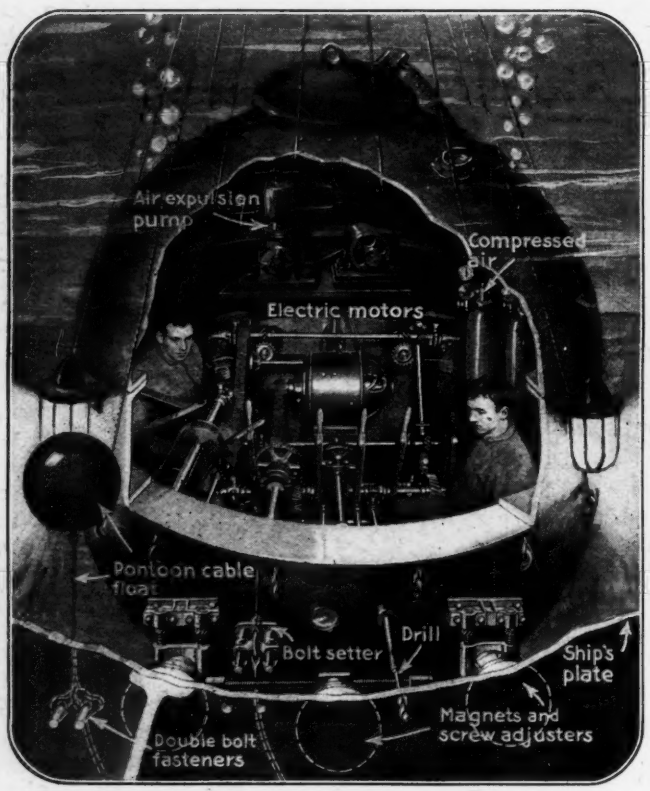
But you'd better hurry. Here's W. D. Sisson, of Los Angeles, Cal., already in the field with a huge diving-bell with which he plans to raise ships by an up-to-date application of the pontoon method.

After the pontoons—great cylinders of steel—have been filled with water and sunk alongside the ship, a diving-bell—built with a heavy cast-iron shell, spheroidal in shape, with a water-tight manhole at the top and a number of glass windows, strongly built to withstand pressure—is lowered. It has working space for a crew of two men, and is equipped with electric motors, a pump to force out foul air, pure-air tanks, drills, powerful electric magnets, machinery for lifting and lowering, and steering propellers.

The electric magnets hold the bell against the ship's side, while drills, worked from the inside of the bell, bore a series of holes in the sides of the vessel. Into these holes a magnetic bolt-holder thrusts expansion bolts fitted with staples, to which are attached cables leading from the pontoons. This does away with the operation—always difficult—of passing chains under the ship's hull. The free ends of the cables are made fast to floats which buoy up the pontoons. An ingenious detail is the adjustable centering of the drill-holes by means of the screw-shaft magnet supports, which are rotated from within the shell by power shafts, and thus move the shell bodily relative to the magnets.

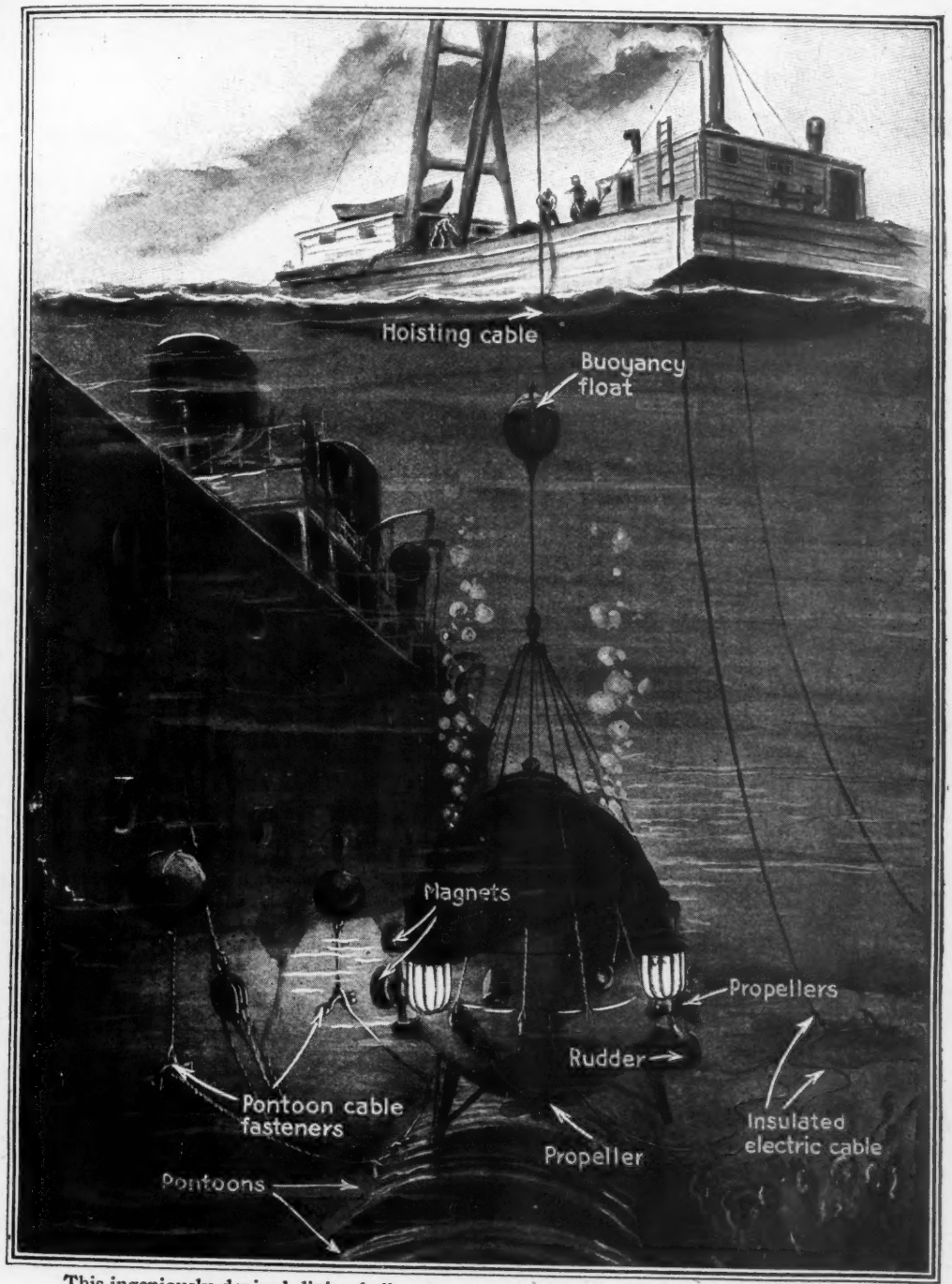
After all the bolts have been fastened, the water is pumped out of the pontoons by electric motors and air is forced in to take its place. Then the pontoons rise, and, by their combined pull, the ship is brought to the surface — provided there has been no hitch in the work. Easy, isn't it?

Underwater operations are clearly visible to the crew through the portholes. Communication with the tender is provided by telephones.



Two men from the inside of this balloon-shaped diving-bell fasten pontoons to the sunken ship, which is then raised by the buoyancy of the pontoons

A Machine-Shop Under Water



This ingeniously devised diving-bell merely serves the purpose of fastening the lifting pontoons to the sides of the ship by means of staples bolted to the iron plates of the hull. Magnets are used to hold the diving-bell against the side of the ship, to drill the holes for the staple-bolts, and to hold the bolts while they are forced into the holes. The power for the motors that drive the machinery and for energizing the magnets is supplied by generators on board of the tender, as are also the arc lights. Compressed-air receivers, with a pump for expelling foul air, provide fresh air for the crew. Telephones furnish communication with the tender

An Airmen's Dictionary

Just as Tommy in the trenches uses terms of his own invention, so have aviators of the American and British air services made their own vocabulary

Above: A "blimp," that is, a dirigible balloon from which is suspended a car shaped like an airplane fuselage

The drum of the Lewis machine-gun. As rapidly as one drum is emptied another is substituted

ACK EMMA—Air Mechanic.

ADVANCED ECHELON — Aircraft park. Headquarters of fighting squadron and also reserve airplane section.

BASE ECHELON — Aircraft park. Headquarters of squadron back of lines.

BLIMP—A dirigible balloon from which a car shaped like an airplane fuselage is suspended.

BOUNCE.—Bad landing, causing the airplane to bounce; often the cause of a crash.

BUMPS.—Irregularities in the atmosphere, causing the airplane to rise or fall.

BURST.—The firing of a drum (forty-seven cartridges) from a machine-gun (usually a Lewis) in the air.

COLLISION FIRING.—Shooting at an enemy airplane flying in the same direction with the object of placing the shots where the enemy will run into them.

CONTACT.—The closing of the ignition switch controlling the engine of the flying machine.

DUAL.—A flight in which two aviators go up in the same airplane.

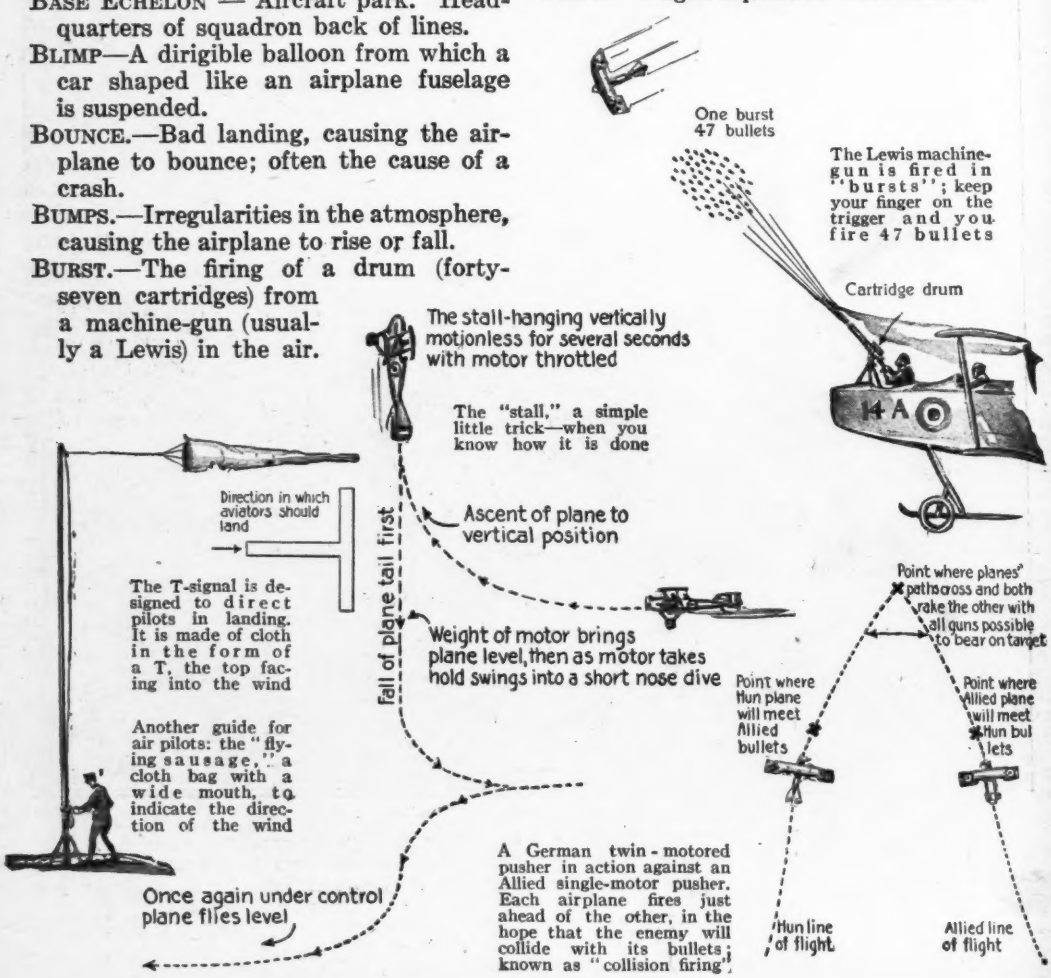
F.L.—Flight Lieutenant.

F.O.C.—Flight Officer Commanding.

FLYING SAUSAGE.—Long cloth bag flown from pole to show direction of wind.

F.S.—Flight Sergeant.

F.S.C.—Flight Squadron Commander.


One burst 47 bullets
The Lewis machine-gun is fired in "bursts"; keep your finger on the trigger and you fire 47 bullets
Cartridge drum
The stall-hanging vertically motionless for several seconds with motor throttled
The "stall," a simple little trick—when you know how it is done
Direction in which aviators should land
The T-signal is designed to direct pilots in landing. It is made of cloth in the form of a T, the top facing into the wind
Another guide for air pilots: the "flying sausage," a cloth bag with a wide mouth, to indicate the direction of the wind
Ascent of plane to vertical position
Fall of plane tail first
Weight of motor brings plane level, then as motor takes hold swings into a short nose dive
Once again under control plane flies level
Point where planes' paths cross and both rake the other with all guns possible to bear on target
Point where Hun plane will meet Allied bullets
Point where Allied plane will meet Hun bullets
Hun line of flight
Allied line of flight

A German twin-motored pusher in action against an Allied single-motor pusher. Each airplane fires just ahead of the other, in the hope that the enemy will collide with its bullets; known as "collision firing".

GIVING HER THE GUN.—Advancing the gasoline control lever so as to turn on the gasoline.

HUNGRY LIZZIE.—Ambulance stationed at flying field.

JOY-STICK.—One of the controls of a plane—worked by the hand.

KISSING THE EARTH.—A crash in which the airplane stands on its nose.

ONE-WINGER.—Observer, who wears a one-wing badge on his uniform.

PANCAKE.—Falling of airplane flat to earth after losing flying speed.

PILLS.—Small hand bombs used for attacking Zeppelins or Balloons from the air.

PROP.—Propeller.

PROP-STICK.—Cane made from a damaged propeller.

RUDDER-TAPPER.—Cross-wind encountered while machine is in flight.

SITTING ON HIS TAIL.—The operating of an airplane so that it maintains a course just above and back of an enemy plane, allowing the Allied pilot to shoot away the Enemy plane's controls.

STALL.—The operating of the controls so as to cause the plane to rise in the air and hang vertically motionless for several seconds.

SUCK IN.—The turning of the propeller by a mechanician while the plane is on the ground, causing the gasoline to be sucked into the cylinders.

T-SIGNAL.—Used to indicate right direction in which airplanes should land.

TAXI.—The operating of a plane so as to drive it over the ground without rising into the air.

TRACERS.—Bullets used in aerial fighting whose smoky course can be seen when fired, to assist in scoring a hit.

TWO-WINGER.—A pilot, who wears the R.F.C. two-winged badge.

UPSTAIRS.—Up in the air.

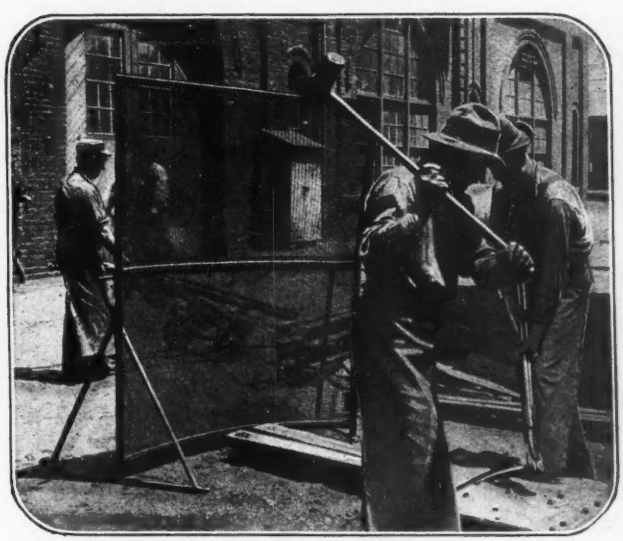
W.C.—Wing Commander, an officer in charge of several squadrons.

WING-TIP FLARES.—Magnesium lights placed under the bottom planes of night-flying airplanes, used only for landing at night.

ZOOM.—The operating of a plane so that it flies up and down like a roller-coaster.

Safety First Wherever the Rivet-Heads Fly

THE commonest method of removing rivets is to cut off their heads with chisel and hammer, and then to punch them out with some appropriate tool. In railway shops and other establishments, where a great many rivets have to be removed, the flying rivet-heads have always been a source of actual danger to the employees working near the place where the rivet-heads were chiseled off. In the shops of the Southern Pacific Company in Sacramento the number of accidents from that source has been greatly diminished by the use of a portable screen, which is shown in the accompanying picture. It is set up wherever rivet-heads are cut off and can easily be moved from one place to another.



The heavy wire screen will stop flying rivet-heads and prevent them from causing injury

© International Film Service

What's he doing up there? Oh, merely taking pictures of the enemy's country

Using the Man-Lifting Kite to Watch the Enemy

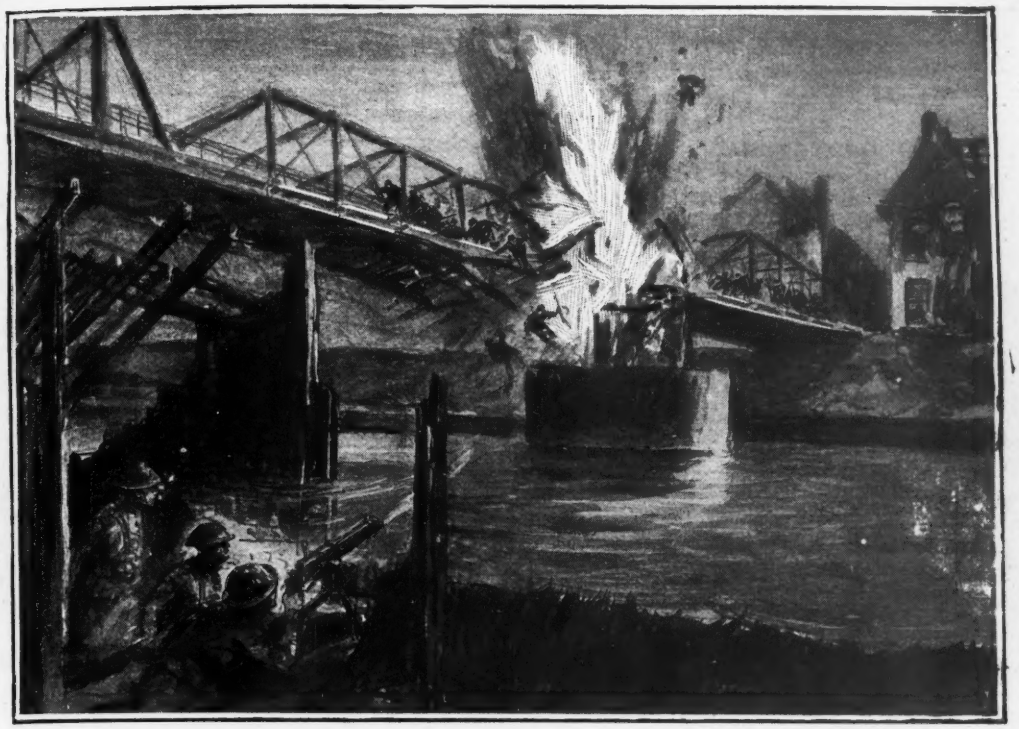
IN England, and also in the United States, experiments were made long before the war to test the utility of man-carrying kites for making observations and taking photographs. The use of kites for observation purposes was suggested and tried in England by Colonel Cody (not "Buffalo Bill," but another American) years ago. For many years kites were used in the United States and in other countries to carry instruments for meteorological observations to high altitudes; but balloons are preferred for war service, because they have greater lifting power and are easier to control.

Experimentation with kites has been revived in England, those used being from nine to twelve feet high and approximately the same width. Two kinds of these kites are flown. In light winds kites are used that present a solid surface; in strong winds, kites of the kind shown in the picture, with square openings in the middle. As a rule, a relay of smaller pilot kites is sent up, followed by the large and strongly built lifting kites.

The relays are attached to piano-wire or ¾-in. Manila rope. Such is the pull of the kite relays that in a strong wind it takes from fifteen to twenty men to hold the line. Swiveled winches, operated by gasoline engines, have recently been substituted for man power. The kites are built from the best spruce wood and canvas, like the wings of an airplane.

Oxidizing Carbon to Make a Powerful Explosive

IF liquid oxygen is combined with carbonaceous material in the proper proportions, it will make an explosive powerful enough for industrial use. The Germans, under stress of necessity, have already done this, and the United States is now conducting experiments along the same lines. Mr. George S. Rice, of the Bureau of Mines, who is in charge of these tests, is using for this purpose a cheese-cloth container holding a mixture of carbonaceous substances, which is then dipped into liquid oxygen fifty-five per cent pure. This oxidizes the carbon with sufficient suddenness for detonation.



On the Germans came, rushing madly upon the bridge. A whole platoon had almost reached the center when the American marines' bullets reached the mine

Marines' Bullets Win in Race with Death

An incident in the recent German drive toward Paris

IT was in the early stages of the recent German drive toward Paris. At Chateau-Thierry, a small town on the Marne south by west of Rheims, American marines formed part of the Allied line. One-third of the town is north of the Marne, two-thirds are south, and a single bridge connects the two sections. The Americans, with their machine-guns, occupied positions in the northern part of the town. To cross the Marne at this point, the enemy must use the bridge at Chateau-Thierry.

The American marines massed their guns around the north end of the bridge. In case they should have to fall back to the other side of the river, they mined the bridge by placing a quantity of powerful explosives beneath the structure; the detonating wires were controlled from the south side of the river.

Wave after wave of German soldiers advanced toward the Chateau-Thierry bridge. The American marines fought bravely, but finally the avalanche of the enemy's troops compelled them to withdraw to the southern bank. The time had come to blow up the bridge to prevent the enemy from crossing; but, when the order was given, the detonating wires failed to work. They had been severed by the enemy's fire.

At once the marines were ordered to concentrate their machine-gun fire on the explosive charge under the bridge. Several guns were trained on the mine, and luminous bullets were used, since darkness was rapidly falling.

On came the Germans, rushing madly upon the bridge under the fire of the Americans. A whole platoon of German troops had almost reached the center of the bridge, when some of the American bullets reached the spot. There was a terrific explosion, and down went the bridge with its load of enemy soldiers.

When You're Ready to Peel Those Fresh-Water Pearls

WHAT is the man in the accompanying picture doing? Wearing two-story eye-glasses, the four lenses of which form a combination equivalent in power to a low-power binocular microscope; and, armed with a sharp knife, he is peeling a fresh-water pearl. It requires a steady hand and a sure touch to do the peeling properly, and the success is always a matter of chance.

He wears two-story eye-glasses—a kind of nose microscope—and he is peeling a pearl with their aid. If his knife should slip he might lose a small fortune

A pearl is built up in layers, like an onion. The layers are very hard, but with sufficient skill one layer after another may be removed or "peeled."

Sometimes a pearl that appears dull, spotted, or imperfect in shape, when peeled yields a pearl of the finest luster and, consequently, of great value. Dull, rough pearls, bought for a few dollars, are sometimes sold for many hundreds of dollars after having been peeled.

But the success of the operation is uncertain. Not always does the peeling improve the appearance and value of the pearl. If the knife of the peeler should slip, and in penetrating the outer layer scratch the inner layer, that scratch would destroy the value of the pearl, no matter how beautiful the luster revealed by the peeling might be.

The nose microscope shown in the picture is a valuable aid in the business of peeling pearls, and saves many a day that might otherwise be wasted.

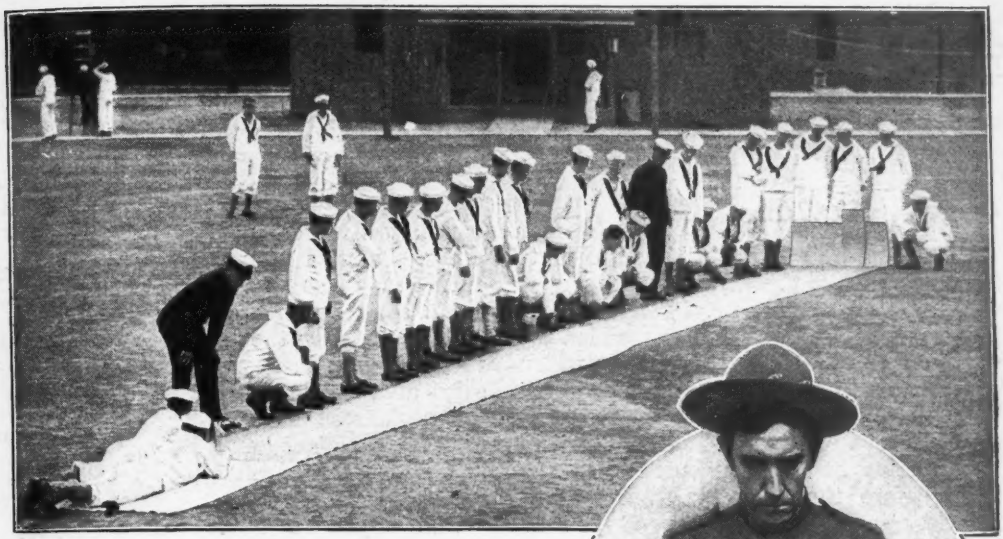
Are There Potato-Bugs in Your War Garden?

"IF the vacuum cleaner will suck dust off the floor, it should pick the bugs off the potato plants in my garden," reasoned Mr. Stanley Smith, of Cincinnati, and proceeded to put his theory to the test. Like many other suburbanites, he was trying to raise potatoes in his back lot. So far, all he had raised was a fine crop of potato-bugs.

Mr. Smith attached a long extension feed wire to a lamp-socket in the cellar of his house, carried his vacuum cleaner to the potato-patch, and connected it with the feed wire. The current was turned on, and the success was beyond all expectation. In a few minutes Mr. Smith, assisted by his daughter, had more than a thousand potato-bugs in the bag of his cleaner.

Nothing easier than this method of picking off bugs from your potato plants. Try it and be convinced

Only five days left in which to mail your contribution to the "Helping Out the Farmer" Prize Contest, announced in the July number. Send it along—you may yet win the First Prize.



If the man with the glasses is up to his job, the next shot will sink a submarine

Learning on Land How to Pot U-Boats at Sea

MANY things that the fighting sailor must know are being taught on land, in these days of intensive training. You might think that to learn to shoot German submarines you would first have to catch your submarine; but not so. A strip of canvas, a toy submarine, and a few pieces of white paper are all that is needed.

The picture above shows a class of the Naval Auxiliary Reserve, the men who will handle our merchant marine, receiving a lesson at the Pelham Bay Naval Training Station. Look closely and you will see, well down the canvas ocean, a miniature submarine on which the attention of the class is centered. The teacher drops a slip of white paper near the submarine to represent the splash of a shell, and the student with the field-glasses "spots" the splash and calls out a correction to an imaginary gun-pointer. If he has estimated correctly the next "shell" will be a direct hit. If incorrectly, the slip of paper will fall away from the mark.

Everything is made to scale, so that the man with the field-glasses sees a close approximation of what his eyes must measure and his brain judge when he meets a U-boat at sea.

After a day in the trenches. The basin is collapsible and weighs only eight ounces

To Help the Boys in the Trenches to Keep Clean

UNFORTUNATELY, trenches, especially those just dug, are not furnished with bath-tubs and hot and cold water. There may be water—perhaps more than desirable—but no way of collecting it conveniently for washing.

The soldier who carries in his kit one of the collapsible rubber wash basins recently placed on the market is indeed fortunate. The basin is made of rubber-coated canvas and is supported by a lazy-tongs frame made of metal strips and provided with hooks which engage in metal-rimmed holes along the edge of the basin. Basin and frame may be folded to fit into a rubber carrying case.

Fighting in a Three-Decker Airplane

Fokker produces a fast triplane in which von Richthofen is killed

By Carl Dienstbach

VON RICHTHOFEN, the German flyer who had more victories to his credit than any other living or dead rival, was killed in a triplane. It was a Fokker of a new type, which the German army had rejected, but which von Richthofen thought was well worth trying. The Fokker is not the first triplane. Both Roe in England and Curtiss in America had experimented with the type before the European war. Why did Germany's best flyer select a type that had been discredited?

The two lower surfaces of a triplane do not give as much lift as they would if there were no third plane above them, while their drift—in other words, resistance against propulsion—is the same. Then, why does the triplane idea persist? Because triplanes are stronger than biplanes of the same surface and weight. By sacrificing some of this inherent strength, Fokker made striking improvements possible.

Obviously, triplanes contain a large surface area within a small span of wings. The entire surface closely surrounds the load it has to support. In a fighting plane, above all, the load must be condensed in order to oppose a minimum resistance to the turns and twists that occur in aerial dueling.

Now, what did Fokker do? He turned the framing of the wings, the hollow, box-shaped beams, and the deep-webbed ribs into a truss. Like a bridge, this structure needed no external bracing wires. The framing was tucked away between the smooth upper and under surfaces of the wings. A single light strut, thin and sharp so that its air resistance is negligible, alines rather than braces the triple wings on each side. The absence of bracing struts and cables reduces the machine's head-on resistance so much that the triplane as a whole became as efficient as a biplane.

The commercial flying-machine of the future will probably be a triplane, because we need compact machines in our cities. The military machine of the future may also be a triplane, because its small span permits quick maneuvering.

The greater the span, the greater the difference in speed between the two sides of a quickly turning airplane. As this difference must not exceed a safe limit, the triplane, with its smaller span, is obviously preferable. A small span accelerates turning.

The triplane's ability to maneuver quickly was the reason why it became von Richthofen's tool in a duel in which sudden turns are paramount.

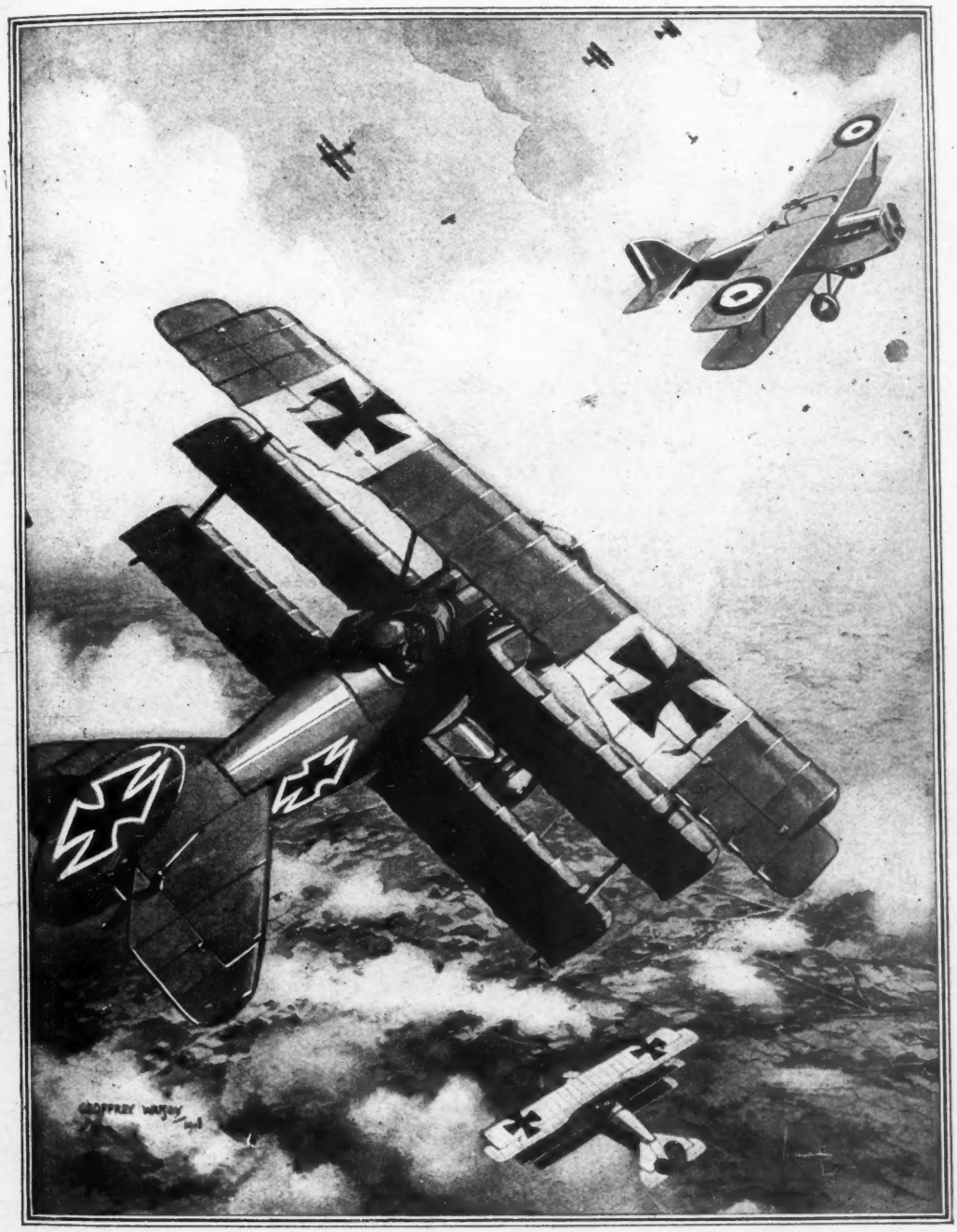
Surface can be piled on surface and certain specifically military advantages obtained. From below and from above, multiplaned machines offer a smaller target. They are safe even after one of the wings has been badly damaged. In a Fokker triplane Captain Boelke would have survived the accident—the tearing away of part of a wing in a collision—that was fatal to him in his Fokker monoplane.

It is a small step from a triplane to a quadriplane or multiplane. The greater the number of planes that are superposed, the less relatively important becomes their reduced efficiency in comparison with their structural advantages.

The Fokker triplane is really a quadriplane. Fokker turned the under frame supporting the landing and starting wheels into a fourth wing. He could give considerable depth and area to this wing, in spite of its necessarily small span. The wheels were disks, forming flanges on each side. This gave to the underframing a certain lifting power, which compensated in a measure for its unavoidable resistance. This fundamental improvement will probably be adopted.

Such a machine has a great speed-range and stupendous climbing power. If it attacks the air at a steep angle it will have great lift at low speed, thus robbing the "airhole" of its terrors and making turning easy while climbing fast.

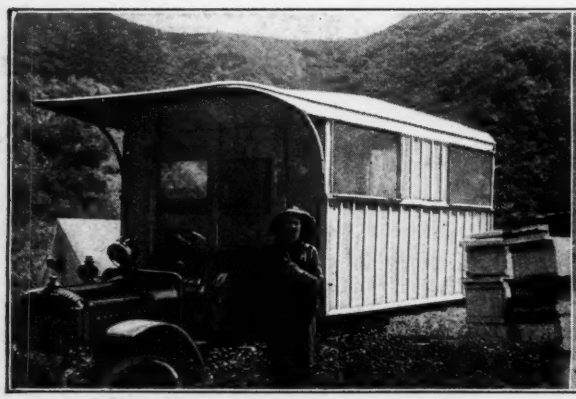
Von Richthofen Flies to His Death



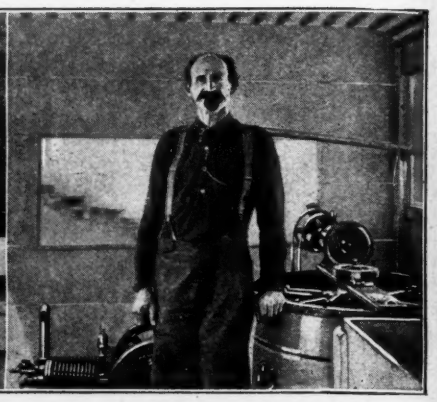
It was in this formidable-looking three-decker Fokker fighting-plane that von Richthofen, the greatest of German airmen, flew to his death. On this Fokker triplane head-on resistance has been cut down by eliminating all wires, and by a new form of landing wheels, mere disks of a stream-line design. Some day an inventor will provide a landing gear that will fold back like a bird's legs. At the moment, the birds are still one hop ahead in this respect

Honey-Bees that Motor to the Flowers

Being an ingenious method of making the busy bee even busier



Bees ride in this motor-truck limousine to the flowers whose honey they are to drain. By visiting the distant orange-blossom and bean-blossom fields in season, the bees have trebled their output



Introducing L. R. Mercer, chauffeur to several thousand bees. He is standing in the truck that serves as the bees' Pullman

A BEEKEEPER of southern California has found a successful way of offsetting the high cost of living. He takes the bees to the flowers by automobile, thus making the most of the blossoming seasons in different localities. The bee-moving process has long been experimented with by others, but Mr. L. R. Mercer, of Castaic, Cal., has demonstrated that it can be made a success. He claims that his honey crop is now almost three times what it was when the bees were kept in one place the year round.

The theory on which Mr. Mercer works is that ordinarily the bee gathers honey in a radius of two or three miles around the hive. For this reason, they either do a lot of unnecessary work in going over flowers that have already been "drained," or they are practically idle a great deal of the time.

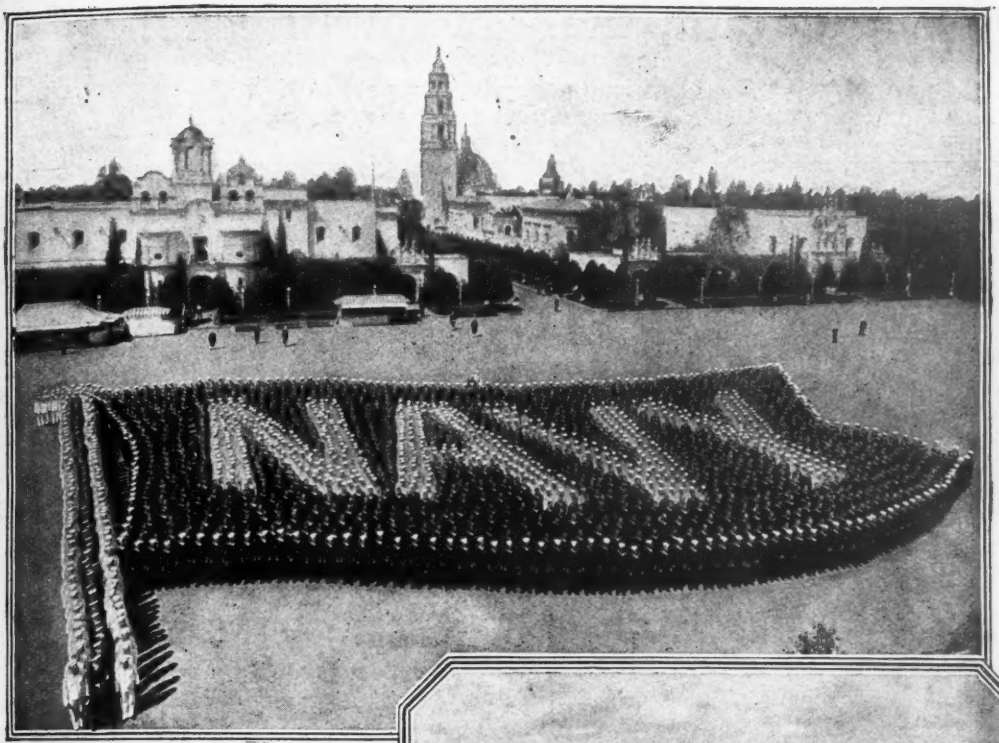
After purchasing a motor-truck chassis, Mr. Mercer designed and constructed a special body, which has screen windows and which is capable of carrying one hundred hives at a time. In the early spring of each year Mr. Mercer conveys his hives by motor-truck from their home ranch in Castaic canyon to the foothills just above Glendora, California, a distance of sixty-four miles, where in the season there are hundreds of acres of orange blossoms. The honey season at Glendora over, the bees are transported to the Ventura district, where they are permitted to remain throughout the summer and tap the bean plants that bloom then.

After the bean-blossom season is closed, Mr. Mercer takes his bees back to the home ranch in Castaic canyon, where they gather honey during the winter from the blossoms of the sage-brush on the mountainsides.

The method of transporting the bees is interesting. After the bees have done their day's work and have retired, the owner carefully closes the entrance to the hives and places them within the truck. All the transporting is done at night. The bees go to bed at Castaic, and wake up the following morning at Glendora, sixty-four miles away. In three night trips the entire apiary is moved.

The body of the truck is equipped with a powerful honey-extractor driven by a gasoline engine. By having the truck equipped in this manner it is not necessary to move the hives heavy with honey; before each moving process the honey is extracted and shipped from the nearest railroad depot.

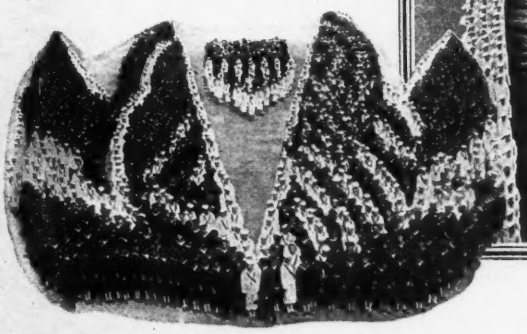
Real Battle Flags of Blood and Brawn

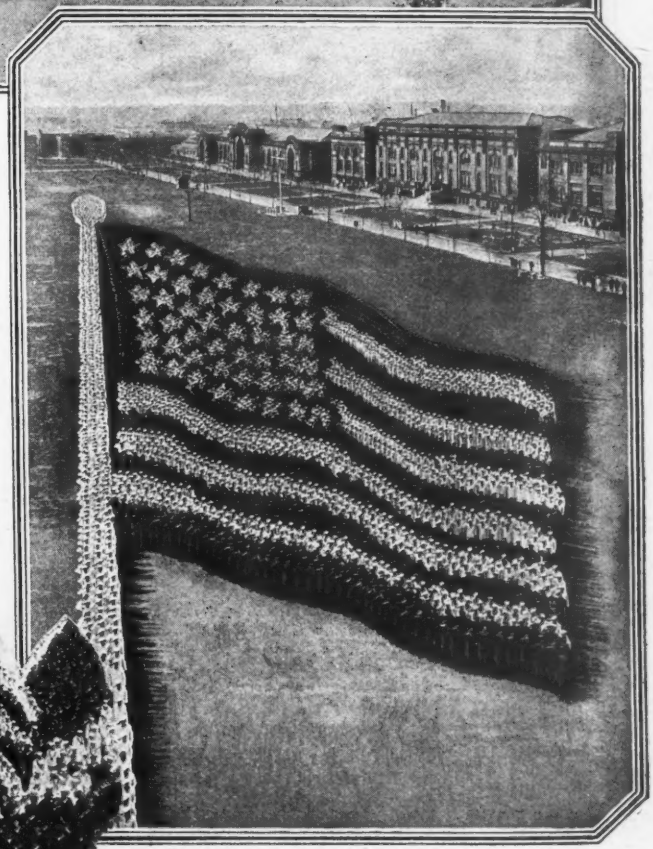


© Western Newspaper Union

Betsy Ross fashioned the first American flag of silk. How her heart would have leaped could she have visioned these giant, living emblems in which the young manhood of the Republic again pledges its allegiance. The one above—a storm warning for German submarines—was displayed at a Pacific coast training station

Expert photographers work out these flags according to the laws of perspective, so that what to the human vision is merely a strangely arranged mass of men becomes to the eye of the camera a living picture—a human flag waving defiance to the foe





© Athletic Association of the Great Lakes

It took ten thousand bluejackets to make this living emblem of union and might

Forward, the Tractor Brigade!

The American guns will keep pace with the advancing infantry in any drive

It takes more than fallen trees, rocks, and piles of brick and masonry to stop the progress of these tractors

FOR days before the big drive the artillery has been firing over the heads of the infantry, which is "dug in" along the edge of No Man's Land, keeping up a terrific bombardment of the enemy lines. The hostile trenches have been destroyed or made uninhabitable; the hostile guns within range have been silenced; and the road is cleared for the drive.

Over the top go the fighters and begin their rapid advance. The wire entanglements have been leveled. The advancing men, supported by their machine-guns, kill or capture such of the enemy as have survived the bombardment.

Hand-grenades and bayonets clean out the trenches and shell-holes, and the forward rush continues until the barrage fire of the enemy's artillery puts a temporary stop to it.

Another zone must be cleared ahead of the zone just occupied. The artillery must keep pace with the advancing infantry to avoid a delay that would enable the enemy to bring up his reserves, place his artillery, and perhaps undertake a counter-attack. But heavy guns and howitzers can not be moved as quickly as infantry over ground cut by trenches, deeply pitted by shell-craters, and obstructed by fallen trees and other debris.

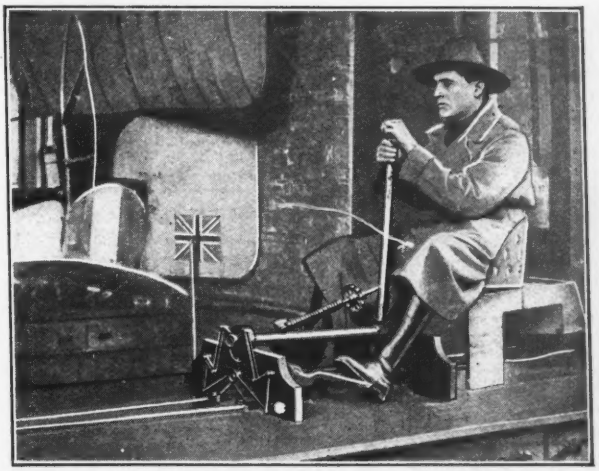
Americans have profited by the lessons of this war. There will be no delay in the forward movement of our artillery when we advance. The Government has planned to equip the army with 40,000 armored military tractors of two and one-half, five, and ten tons capacity, capable of hauling all but the heaviest pieces of field artillery over the roughest ground at a rate of from six to eight miles an hour.

Flying on the Ground with the "Joy-Stick"

TIGHT-ROPE walking requires a well developed sense of balance and a highly responsive action of the muscles. But, in some respects, tight-rope walking is not so hard as maintaining your balance while flying through the air at great speed. An airplane is about as unsteady as a drop of quicksilver on a moving glass plate.

The aviator controls the balance of his machine by means of a lever that has been given the characteristic name of "joy-stick." It controls the ailerons (balancing flaps) on the wings. The joy-stick is a lever normally in a vertical position, and movable in a vertical plane at right angles to the line of flight. It stands in front of the driver's seat, and is controlled with one hand, so that a machine-gun can be fired with the other. To right the machine, the driver pushes the lever toward the side that happens to be too high—a movement that is strictly in accord with instinctive tendency. The rudder, which controls the line of flight, is moved independently by the feet.

The proper handling of the joy-stick requires a well developed sense of balance, and a great deal of practice is required before it becomes mechanical. Aviation students must be perfectly familiar with the working of the joy-stick before they are allowed to fly. Instructors say that students who are impulsive are disqualified from becoming successful flyers. The joy-stick must be handled with great delicacy; a sudden, violent shifting may wreck the machine.

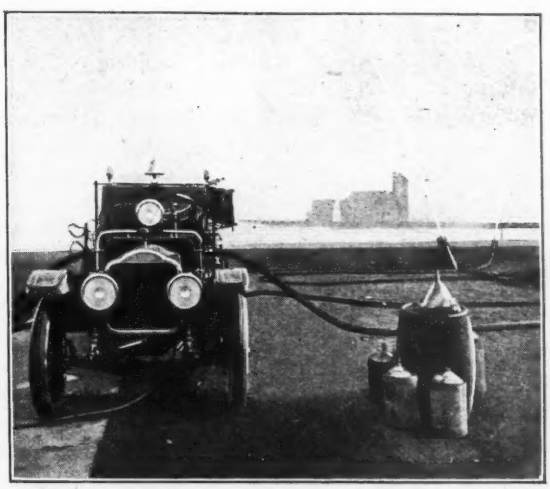


First step in aviation. Oscar is learning how to use the "joy-stick" on the ground

A Champion Flame-Fighter at Work

A FIRE-ENGINE that can stay on the job for two days and a half, throwing 625 gallons of water every minute, and never stopping for an instant, ought to be able to conquer a stubborn blaze. That's the record made recently at Chicago by a new combination automobile fire-engine and truck.

The record beats the best previous one by forty hours. When the machine had been pumping for twenty hours, fire chiefs from all over the country, who were holding a convention in Chicago at the time, went down to the pier on the lake-front to see the wonder at work. They studied it much as a horseman examines a thoroughbred, and found that after sixty hours of continuous work the machine was sound in wind and limb, or, as the experts certified, "the entire motor and pumping equipment was in a very satisfactory condition."



If some burning intellect had set the Chicago River on fire, this pumper would have put it out

The gun crews in these pictures are numbered, in order that the recruit may follow easily the movements of any member whose position he is qualifying to fill.

How We Are Making

Motion Pictures Have Been Called Staff in Increasing the Fighting

The information contained in this article and the pictures accompanying it were supplied by the Chief of the Training and Instruction Branch, War Plans Division of the War Department. The article has been submitted to the Department, which has authorized POPULAR SCIENCE MONTHLY *to publish it. The illustrations were made from films actually used in army training.—THE EDITOR.*

WHAT makes a man a champion? Not brute strength alone, not aptitude alone, although strength and aptitude are requisites. If merely brute force and luck were required to drive home a bayonet, a modern army would be nothing more than an armed mob. A champion is distinguished by his motions: he saves energy; he does things in the simplest way.

The main difference between the veteran and the recruit is a difference in motions. This applies not only to the infantryman, but to the artilleryman, the cavalryman—in a word, to every man in every branch of the service. A champion fighter is a man who knows how to move his arms and legs. Hence the foundation of an efficient army is to be found in the science of motions.

The old principle of "any old way, just so long as you deliver the goods," is fast disappearing. The sheer necessity of the present war demands something better. We are meeting an unprincipled, resourceful, cunning, and highly organized enemy. Unskilled men have no place in an organization that fights the German machine. Every unit in the German machine is a champion—a picked man trained by a picked officer. Only by producing an American machine composed of even more highly trained units can we hope to win great victories on the battlefield.

The Job of Raising an Army in a Republic

The problem of training soldiers presents extraordinary difficulties in a country such as ours. When we entered the war, for instance, more than a hundred thousand officers were needed. Lawyers, doctors, business men, citizens from all walks of life, entered the service; and, of all this vast number, only a negligible few had had any previous military training. The War Department was suddenly confronted with the stupendous task of molding not

A "close-up" of the gun team in action

an Army of Champions

to the Colors to Aid the General Efficiency of American Soldiers

only drafted men, but officers, into an efficient standardized fighting machine. The ordinary man can never realize the magnitude of the undertaking.

It is obvious to every reader of the newspapers that time is an all-important element in war, and particularly in this war. To weld our man-power into shape with the least possible loss of time, the General Staff of the Army had always to bear in mind two cardinal principles: first, to avoid a repetition of the mistakes made by our Allies in the early part of the war; second, the attainment of the highest efficiency possible.

The escaping steam would disclose to the enemy the position of this gun. The vapor also interferes with the gunner's view. The Browning machine-gun here shown in operation is water-cooled

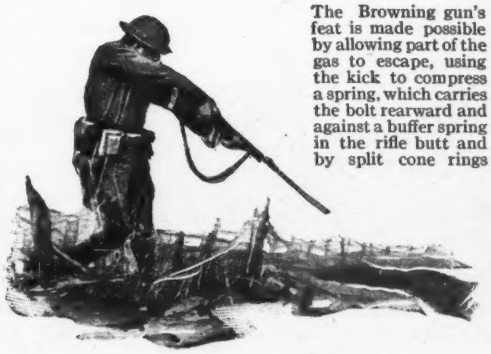
A way had to be discovered of teaching officers and men on a wholesale scale, and yet thoroughly and conscientiously. Teaching from technical text-books alone is too slow. Text-books do not stir the interest, and without interest the process of learning becomes drudgery. Casting about for the most effective way of attaining its purpose, the General Staff decided that the motion picture was an ideal medium.

This condition is effectually eliminated by the adjustment of the steam-condenser here shown. It is easily and quickly attached to the gun-muzzle

The Army Makes Use of Our National Pastime

We are a nation of motion-picture theater-goers. Salesmen have found it easy, with motion pictures, to sell agricultural machinery, engines, and complicated mechanism that no prospective customer would ever study from blue-prints or printed descriptions. Technical institutions have been using the motion-picture with telling effect in teaching the principles of shop work. Why not apply the same idea to the training of an army? The General Staff was quick to realize its possibilities, and is to be credited with having for the first time in history converted the film into a living, interesting military text-book.

It is too early, as yet, to summarize the economies that the motion picture has effected in training men to whom the complicated machinery of warfare was a sealed book; but it is not too early to state that the economies effected can not be overestimated, either in dollars and cents or in time saved. It has proved in every way efficient to obtain efficiency itself by actually showing a man how a thing is to be done on the



Firing 500 shots a minute into a lake with the Browning to show absence of recoil

The Browning gun's feat is made possible by allowing part of the gas to escape, using the kick to compress a spring, which carries the bolt rearward and against a buffer spring in the rifle butt and by split cone rings

The same gun in action with the condenser attached. Nothing there to betray the presence of the gun

screen, rather than telling him about it by word of mouth or by letting him read it from a book. The rapidity with which the brain grasps information through the eye is fully realized only by the editors of newspapers and by teachers.

Mr. Browning Tells About His Wonderful Gun

Now, it must not be supposed that the service text-books are thrown into the waste-basket. They are far too valuable for that—indeed, indispensable. The General Staff has organized a motion-picture staff for the purpose of animating the text-book, as it were—to make it alive, to drive home the principles that it elucidates in a concrete, active way.

Hence the most competent and experienced instructors have been enlisted to appear before the camera, and by their photographic example to demonstrate how the essential drills are to be executed.

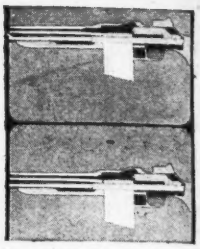
Since our soldiers in France are using the French 3-inch gun, it is necessary to instruct our men in this country in its use

Imagine yourself in a dark room. The silence is broken only by the whirring of the projecting machine's motor and the passing of the film before the lens. On the screen you see what? John M. Browning, inventor of the Browning machine-gun. You meet the man himself—his disembodied photographic personality.

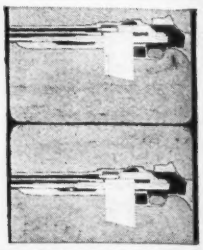
Would you not rather learn the mechanism of that remarkable gun from the inventor himself than from anyone else? Of course you would. And so Mr. Browning points out the different parts of his wonderful gun, and names them. He shows you how the gun is taken apart; how it is cleaned; how it is put together again; how it works. Even the mistakes that are likely to be made by an uninstructed man are called to your attention by Mr. Browning on the screen.

No text-book could so rivet your attention; no blue-print could fascinate you as does this picture on the screen. You can't help but learn, for the demonstration is a little drama in technology.

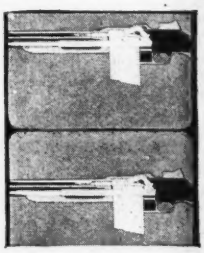
The champion does things in the best way, whether he be a champion tennis-player, or a champion bricklayer. There is just one best way to curry a horse, to aim a gun, or to drive a bayonet into a human body, and that way is the champion's. Every one wants to be instructed by a champion. Since there are not enough champions to instruct an army that numbers its officers and men by millions, motion pictures serve the purpose of multiplying a single champion hundreds, even thousands of times. A single man, an expert in his chosen field, can be photographed once and for



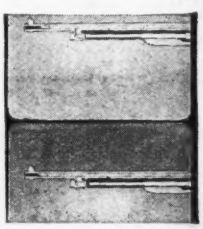
Showing a longitudinal cross-section of the Browning automatic rifle while being fired. The bolt is here in the cocked position



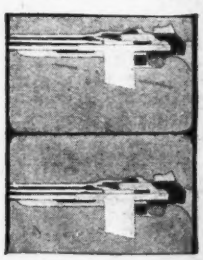
Continuing, the bolt is shown pushing the cartridge from the magazine into the bore



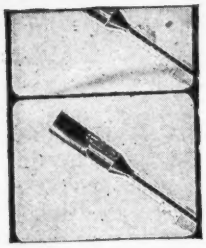
The bullet leaving the sheet under pressure of the expanding gas. The action is retarded so that one may see exactly what takes place.



At this point the gas has passed through the port under the barrel and is seen forcing the piston rearward. As the piston moves rearward it compresses a spring



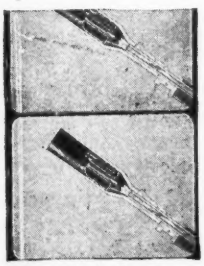
The spring now comes to view. When it is released this pent-up force carries the bolt forward again. The two forces just described constitute the principle of automatic gas-operated rifles



The discharger with grenade inserted and photographed so that you may study its mechanism

all, and the film used to teach a whole army. This method of teaching, moreover, leads to uniformity of result. It is better to teach all men to follow the example of a single champion than to use a hundred champions. Clearly, no hundred champions will ever be equally efficient. But the motion-picture champion—the one man who embodies in himself all that the army wants to impart—can magically transport himself from New York to San Francisco and exhibit himself in a hundred places at once for the instruction of recruits.

Three different kinds of motion pictures have been developed, and by means of these three different types of pictures the screen is made to reveal events and actions that are never seen in real life.

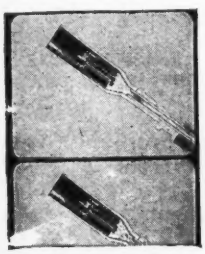


The bullet is here seen about to enter the tube of the grenade. The smallest detail is made plain for the students

The Three Types Used in the Army

The first type of picture is not essentially different from that which is exhibited in every motion-picture theater. Photographs are made of men drilling; of artillery in action; of cavalrymen; of the many different phases of army activities.

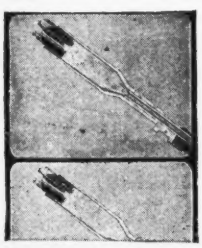
The second type of film is not generally known to the public. It is made with the assistance of a speed camera. To explain what that is, let it be said that the ordinary motion-picture camera makes exposures at the rate of sixteen per second. The speed camera, however, makes ninety-six per second. The pictures are projected on the screen, not at the rate at which they were taken, but at the standard rate of sixteen. Hence motions executed with the utmost rapidity appear to be of snail-like slowness. And, because they are slow, they can be studied.



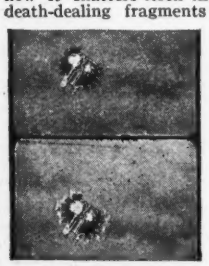
The grenade fuse is set off by the bullet. While the fire burns toward the detonator, gases accumulating behind the grenade force it out, as shown in the next picture

Suppose it is desired to know what a horse does when he changes his gait, and where the center of gravity of a rider should be. The army uses hundreds and thousands of horses. If it could teach men quickly how to ride, it would save many a horse from acquiring a sore back while imparting worth-while knowledge to cavalrymen.

The ordinary motion-picture camera will not catch the motions of the horse and rider so that they can be projected for convenient study. But use the speed camera, and the animal moves at one-sixth of its actual speed. Hence every phase of its action can be studied.

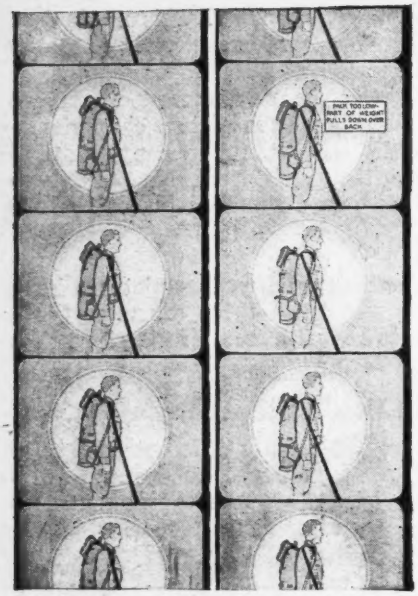


The explosion of the grenade is also retarded so that you may observe how it shatters itself into 50 or 60 death-dealing fragments (see below)

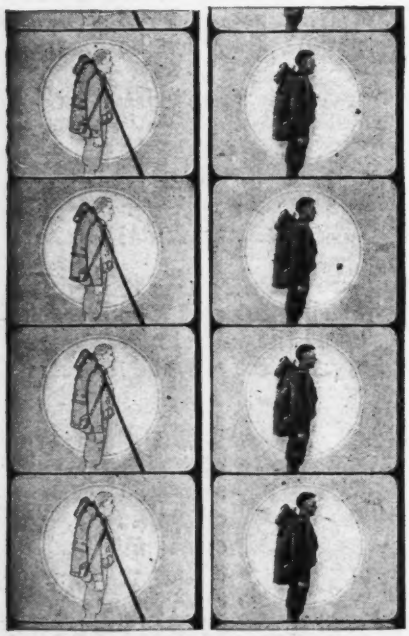


How does a grenade discharger work? All you have to do to find out is—look. On the screen everything is made plain

The third type of picture, the animated cartoon or drawing, has become familiar to the public through the work of well-known newspaper artists. Nearly all of these films are burlesque or highly



At the left: A diagrammatical drawing in motion to illustrate the proper method for carrying the pack, and the scientific principle upon which the theory is based. Properly adjusted, the shoulder-straps will be horizontal. At the right: The pack as here seen is carried too low, exerting undue downward pull upon the shoulders. This is extremely fatiguing



At the left: As the motion picture progresses the pack is seen to rise, illustrating the error of carrying it too high. In this position the pressure of the straps is very uncomfortable. At the right: Having served its purpose, the diagram dissolves to the actual photograph of a soldier properly carrying the pack

comic in character. Only a few have been made for purely educational purposes. It takes time and patience to make an animated drawing.

A motion picture of any kind, be it remembered, is composed of hundreds of pictures following each other in natural sequence so as to show the beginning and end of progressive movement. That these hundreds of pictures seem to be continuous is due to a phenomenon known as "retinal persistence." By that we mean the inability of the eye to see each picture separately as it flashes by. It is because the eye is slow that motion pictures are possible.

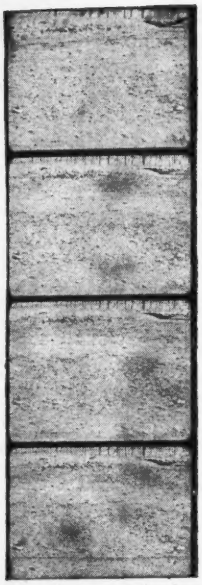
To make an ordinary drawing, hundreds, even thousands of separate pictures must be drawn by an artist. Each picture shows a moving part in a position slightly in advance of that shown by its predecessor on the screen. When these drawings are projected at the rate of sixteen a second on the screen, the result is a real and convincing demonstration of motion, even though the subject may be as fantastic and as absurd as that of the ordinary motion-picture cartoon.

The U. S. infantryman carries his pack after the fashion of the Indian squaw with her papoose

In army work the animated drawings have been applied to show how the entire mechanism of an automatic rifle works — something that can not be revealed so realistically even with the aid of the rifle itself. Moreover, the movements of the various parts can be so timed that the course of the bullets and of the gases can be readily followed. In this field alone army use of the motion picture has justified itself.

Whole Process Simplified by Moving Pictures

Can you tell a man, from the mere aspect of an automatic pistol, how it works? Would it not be laborious even with the aid of a drawing? On the motion-picture screen the whole process is reduced to something like axiomatic simplicity. The trigger is pulled; you see it. The striker hits the primer; again you see it. The powder gases explode; you see them expand. A piston is pushed by the gases to operate other mechanisms. Nothing is left to the imagination. Everything is revealed to you.



A perfect example of camouflage. Here, right in your path, is a deadly machine-gun that is ready for instant business. Can you locate it?

The method has infinite possibilities. There is hardly a subject that can not be elucidated by means of the animated drawing. How the cylinders of the large guns recoil, how bullets fly through the air to their mark, laws in mechanics that are dry and meaningless to those who have not been schooled in mechanics — all become dramatically interesting, all assume a new meaning and dignity.

How Our Army Was Speeded Up

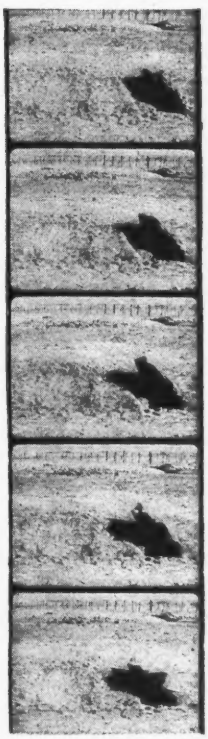
At the request of the United States Government, hundreds of experienced officers have been sent to these shores by our French and British Allies in order to help us train our armies.

Six seconds have elapsed from the time the view of the flat ground was taken. The gun is already in action

Because we have many kinds of instructors, there is a very obvious need of standardization. The recruits from California and the recruits from Virginia and Texas must receive the same training, if we are to avoid friction and confusion in our war machine. The motion picture has reduced the possibility of that friction and confusion to a negligible minimum.

Up to the present time, twenty-two subjects have been completed. They will serve to instruct the men in all branches of the service, and they will be used to train troops numbering at present nearly two million men.

The first step in preparing a reel is the writing of a scenario, in which everything to be shown is tabulated in detail. The next step is the coaching of the champion or super-expert in the presentation of the subject chosen.



Here the moving-picture camera has caught the gun just ready to spout

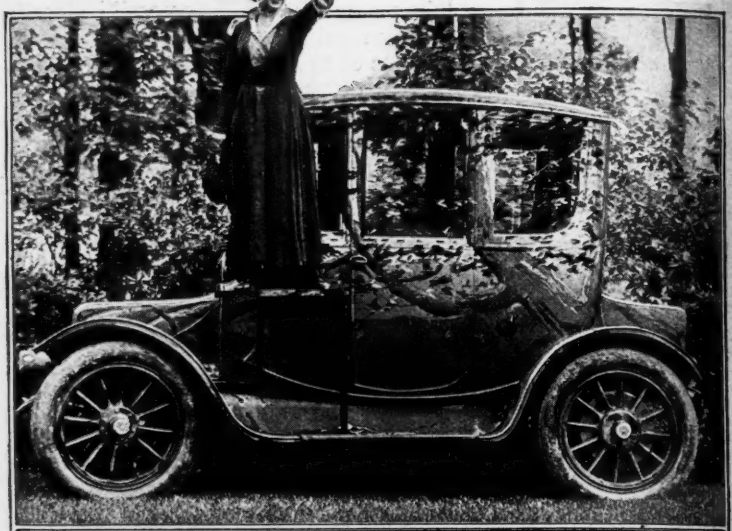
This super-expert rehearses his part far more thoroughly than is demanded of an ordinary motion-picture actor. Human lives depend upon his intelligence. Defeat or victory, too, rests to a certain extent with him. It must not be forgotten that all champions are not necessarily first-class teachers.

The next step is the taking and developing of the pictures. After that they are shown to large gatherings of critical technical experts. Then they are re-edited, submitted to the General Staff for final approval, and distributed throughout the service.

So successful has been the motion-picture method of instruction that the demand for more and more reels, and for education in more and more advanced work by means of the film, is increasingly insistent.

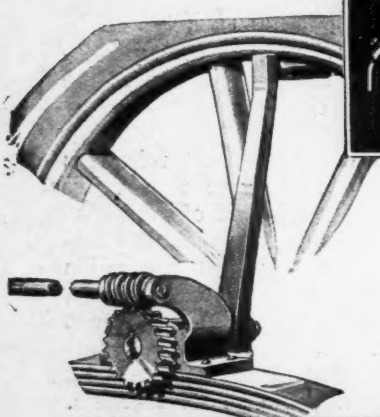
Giving Mechanical Aid and Comfort to

An automobile disguised to attract attention in a recent thrift stamp campaign

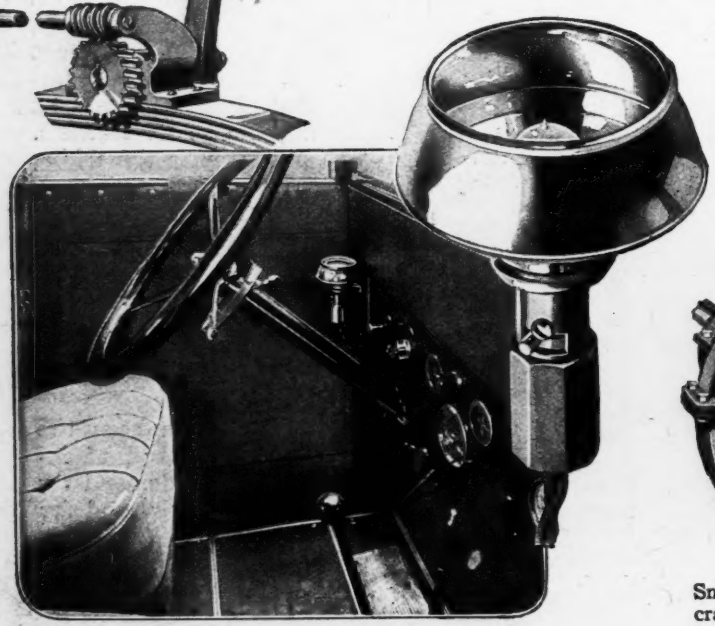


A split used in an auto-jack to permit the plunger to drop when axle is to be lowered

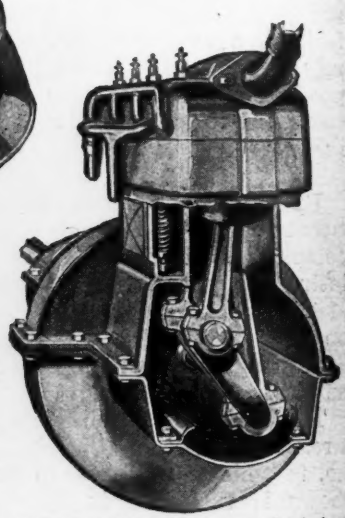
An auxiliary automobile headlight which throws the light down when driving through city streets



At the left is shown a lowering device for the spare wheel, which is attached to the rear spring



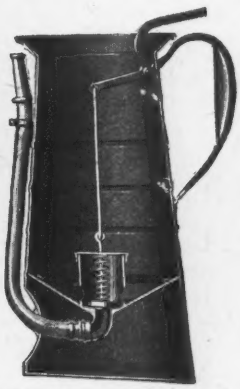
Small spot-light for ready attachment to the storage cells of an automobile for emergency use



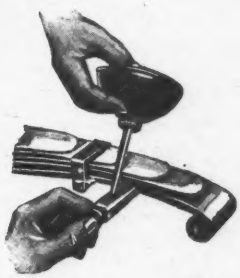
Small baffle plate attached in crank-case for the purpose of keeping oil in pan when the engine is running at high speed

A creeper spring bed with rollers attached enables the repairman to work at ease

This ranger in the picture at the left, having accidentally smashed his radiator in the desert, replaced it with a milk can

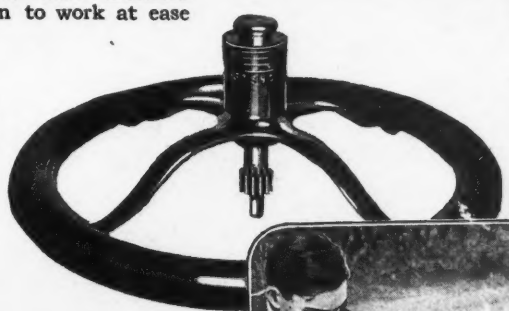


Measuring can with strainer at bottom and discharge outlet through nozzle



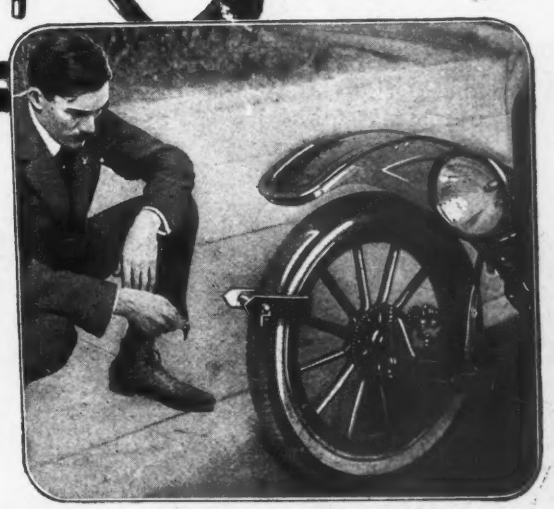
The wedge is pushed in between the leaves of the spring, and the groove in its surface carries the oil in

At the right, a lock attached to the steering wheel prevents its turning

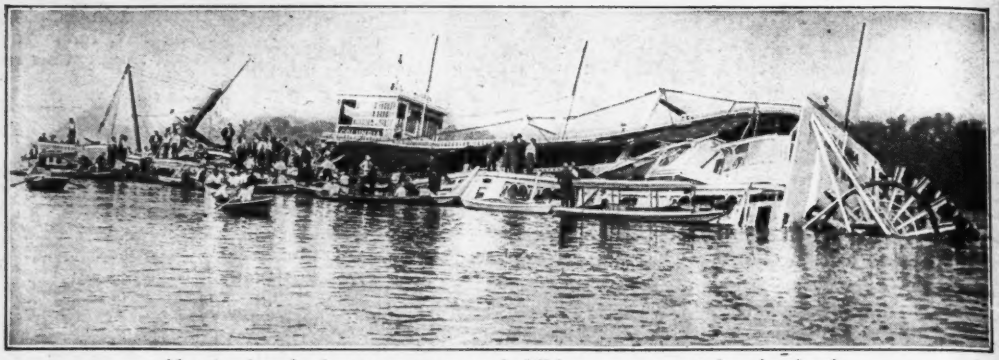


A twin spark plug in which two sparks fire independently

This filler cap strainer spreads in funnel shape when pushed out as the cap is removed



An auto-theft signal on front wheel becomes a mud-hook when fastened to rear wheel



About a hundred men, women, and children were overtaken by death when the excursion steamer "Columbia" sank in the Illinois River

Not a U-Boat—Just a Snag in the River

THE sinking of the excursion steamer *Columbia* in the Illinois River recently is another illustration of the fact that, even in this day, man is not yet completely master of the elements. Compared to an ocean voyage, with its perils from submarine and storm, a trip on the Illinois River seems safety itself; and certainly there was no thought of peril in the minds of the five hundred men, women, and children who had enjoyed a perfect summer day on the water and were returning home.

The big stern-wheel steamer ploughed her way along steadily, the excursionists dancing, singing, and feasting with as much security as though in a hotel on shore. Then came the crash of rending wood and iron. The boat stopped short, swung about, and began to back slowly. The moment of panic was followed by one of reassurance, and then came frantic terror and indescribable confusion as the *Columbia* keeled over and began to sink. She had run upon a sand-bar or a snag, which had broken her backbone.

River steamers of this type are not fitted with water-tight compartments, and such bulkheads as there are have little or no resisting power; so when the *Columbia* broke in two she sank to the river-bed almost at once.

Nearly a hundred of the merry-makers were drowned, in spite of the boats that swarmed about the sinking steamer. An investigation of the accident was ordered, and an effort will be made to raise the partly submerged boat.

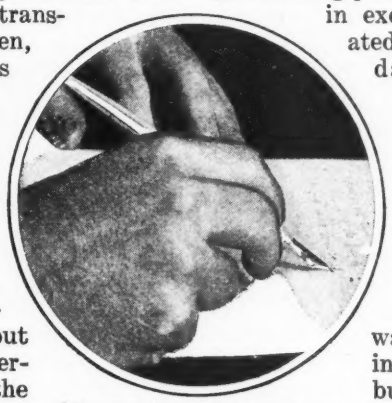
No Wonder This Bull Put Up at the Best Hotel

DURING the shorthorn cattle sale at Ashville last May, Mr. Roan Prince and Mrs. White Rose were guests at the Hotel Langren, and we are privileged to present their pictures, posed in the special suite prepared for them. The bull and his lady were entertained by the Red Cross. That was very nice of the Red Cross, and also very nice for it, since Roan Prince was given to the organization by I. F. Derby, of Athens, Alabama, and the Athens chapter was richer by $12,600 when Dr. I. V. Legg bought the celebrated shorthorn at auction.

Unusual hotel guests? Yes; but the gentleman on the right is worth $12,600

Promoting an Ordinary Steel Pen into a Fountain Pen

BY means of an ink-feeding attachment that can readily be affixed, an ordinary steel pen can be transformed into a fountain pen, which writes as many as five hundred words without refilling. As shown in the photograph, the ink-spoon serves as a reservoir for the ink, which runs down the slit in the nib as needed. The ink remaining when the pen is no longer required can be drained out by placing the pen in a vertical position against the inkwell and pressing slightly. The ink-spoon is cheap, as compared with the fountain pen, and enables the user to select the particular kind of steel pen which he prefers for his own work.

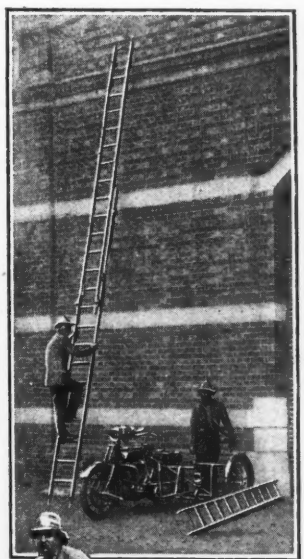


It's an ordinary steel pen, just as you supposed, but it's been changed to a fountain pen

Five cents will buy one of these ink-spoons. If it is warranted not to clog, it ought to work as well as a fountain pen.

A Motor-Cycle Ladder in Electric Light Work

A COLLAPSIBLE ladder strapped to a motor-cycle, as shown in the illustration on the right, is employed by the electric department of Pretoria, South Africa, for installation, repair work, disconnecting and connecting. Pretoria, which is one mile wide and seven miles in length, has 4,600 electric light consumers who are supplied by wires supported by poles thirty-six feet in height. The ladder motor-cycle has demonstrated its worth by reaching points in the lighting system in excellent time. It is operated about fourteen hours daily, averaging more than forty miles. It weighs about 260 pounds and is put up in sections.



A collapsible ladder strapped to a motor-cycle which is used by the lighting department of Pretoria, in Africa

Mines and Mining at the Battle-Front

ASIDE from fighting and keeping a close watch on the enemy, soldiers in the front line trenches are busy digging more trenches or improving their dugouts when on duty. Occasionally some are detailed to dig tunnels and lay mines. These mining operations are carried on under the direction of army engineers. The construction consists not only of offensive mines attacking enemy strong points, but systems of countermines with the object of detecting and repelling enemy operations.

Tunnels are dug underground leading to points beneath strongholds of the enemy, at which explosives are deposited and set off by time fuse. The blowing up of Messines Ridge by the British in their drive in 1917 is a conspicuous example of such mining operations.

A campaign is constantly going on underground with the aid of microphones and other listening devices. When an enemy tunnel is discovered, it is blown-in by running a boring close to its wall and exploding a quantity of explosive sufficient to destroy the tunnel, but not to disturb the upper surface of the ground. The name camouflet, a word of French origin, has been given to such a mine.

Shooting Birds from Airplanes—A New Sport

NO sport is so ancient and captivating as hunting. It was not always sport. In the early days of the human race hunting was a necessity, almost the only means of subsistence. Later it became the favorite pastime of a constantly narrowing circle of devotees. In feudal times it was the exclusive privilege of kings and noblemen.

There is an old saying: If the cat had wings it would go ill with the sparrows. Winged man can be even more destructive

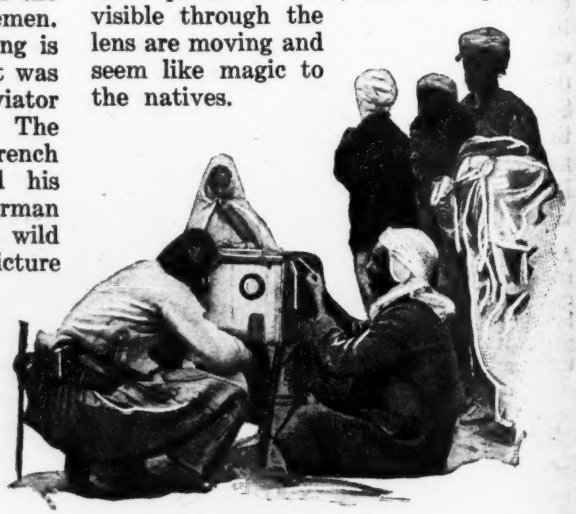
The latest development in hunting is duck-shooting from an airplane. It was first tried with success by the aviator Hubert Latham, a few years ago. The accompanying picture shows a French aviator in Servia who employed his leisure time, when not chasing German or Austrian airplanes, by shooting wild ducks from his airplane. The picture shows him with the double-barreled shotgun he used to kill the ducks which hang like a festoon on the outside of his fuselage. The modern Nimrod evidently had a successful day, judging from his fine "bag."

The aerial hunter is by no means restricted to flying game. With a driver to steer the machine, the hunter can devote himself exclusively to the pleasure of the chase while going through the air at eighty miles an hour. It is not likely, however, that hunting in airplanes will ever become a popular pastime. Airplaning as a pleasure is a trifle too expensive and risky and becomes even more so when combined with hunting. In addition there is the drawback of gathering in the game after it has been shot. Nevertheless, laws prohibiting hunting in airplanes have been enacted in several states. It was feared that hunting in airplanes, being so much easier than other methods of hunting, would soon cause the complete extermination of every kind of game.

Even Far-Off Fez Succumbs to the Fascination of Moving Pictures

EVEN the dark-skinned natives of picturesque Fez are not able to resist the fascination of moving pictures. The interesting and thoroughly characteristic street scene in Fez, shown in the accompanying picture, bears witness to that fascination.

Heaven only knows where the shrewd old Arab in the foreground learned of moving pictures and their mechanics and where he picked up the outfit with which he is earning a living at the rate of two centimes a peep. The machine which the old Arab uses is probably of a most primitive kind, but the pictures visible through the lens are moving and seem like magic to the natives.



"Gather around, ye faithful, and see the white magic of the moving pictures! Only two coppers a peep!"

Driving Them Nine a Minute

Unearthly din in our shipyards foretells trouble for the Kaiser

By Frank Parker Stockbridge

The broad grins mean that "the gang" has just hung up a record at the Northwest Steel Company's plant by driving 4,091 rivets in nine hours, and besides, they had two bad ones to cut out and lost fifteen minutes on slight repairs to the machine

THE contest for the title of "World's Champion Riveter" is in full swing. Records are being broken almost weekly. The competition began in March of this year and the title has passed since then twice across the ocean; from the Atlantic Coast to the Great Lakes, and for a few minutes to the Pacific, with the Gulf ports as strong contenders. Just as this is written it seems to have been captured in Ireland by the incredible performance of John Moir of Belfast. According to cable dispatches, he drove 12,209 rivets in nine hours in a standard ship. This far exceeds the best previous record, made by Charles Knight, an American negro riveter at the Sparrow's Point Bethlehem yards, near Baltimore. Knight drove 4,875 three-quarter-inch rivets in nine hours. For this feat he was awarded the prize of $125 offered by Donald McLeod, a British shipbuilder. It was a profitable day's work for Knight and his helpers.

From the early days of March, when construction work under the U. S. Shipping Board's huge program began to get well under way new high records for rivet-setting were, for a time, of almost daily occurrence. Seven hundred rivets in a nine-hour day had been regarded as a remarkably good performance for the standard "gang" of riveters, "holders-on," "passers-up" and "heater-boy," even with the best of modern high-speed pneumatic riveting hammers. Under the spur of high wages and the patriotic urge to speed up shipbuilding, gang after gang began to double and even treble these figures. The game began at the Submarine Boat Company's yard at Port Newark, N. J. John Frederickson started it when he drove 836 seven-eight-inch rivets for a day's work. The word spread to other shipyards and C. McBride, at the Pusey and Jones shipyard, Wilmington, Del., topped it with 1,016 rivets of the same size, an average of 113 rivets an hour. McBride beat his own record a little later with 1,031 rivets. Then Henry Beckels, at the Downey yards on Staten Island, startled us with 1,089 rivets. Baltimore took the lead next, Charles Golderick and Louis Rehak of the Baltimore Drydock and Shipbuilding Company driving

We are sorry that the gentleman on the left isn't attending more strictly to business. He is running a pneumatic caulker and, as it is important to have deck plates water-tight as well as strong, he ought not to be so interested in the other fellow who is driving rivets

respectively 1,202 and 1,414 rivets, working only eight hours. But while their mates were still cheering them word came from Buffalo that John Fraser of the American Shipbuilding Company had driven 1,624 rivets in 8 hours and 43 minutes.

John Stark started out in the Buffalo yards to take Fraser's figures down. He succeeded, setting 2,089 rivets in 8½ hours. While he was doing it Charles Schock, at the Baltimore yards, drove 2,720 rivets in nine hours. This unparalleled feat by Schock attracted attention in every shipyard in the civilized world. Lord Northcliffe published the figures in his London papers and on April 20th Robert Farrant, in the Fraser and Fraser yards at London, proved that the English were not so slow by driving 4,267 rivets in nine hours. Even a new American record of 2,919 rivets in eight hours made by Edward Gibson at the Federal yards at Kearney, N. J., did not compare with this.

But Gibson's figures did not stand very long as the American record. John Corrigan beat them at Chicago with 3,415 rivets in nine hours, an average of 379 an hour against Gibson's 365. That stood as the highest American record until Knight's prize-winning performance.

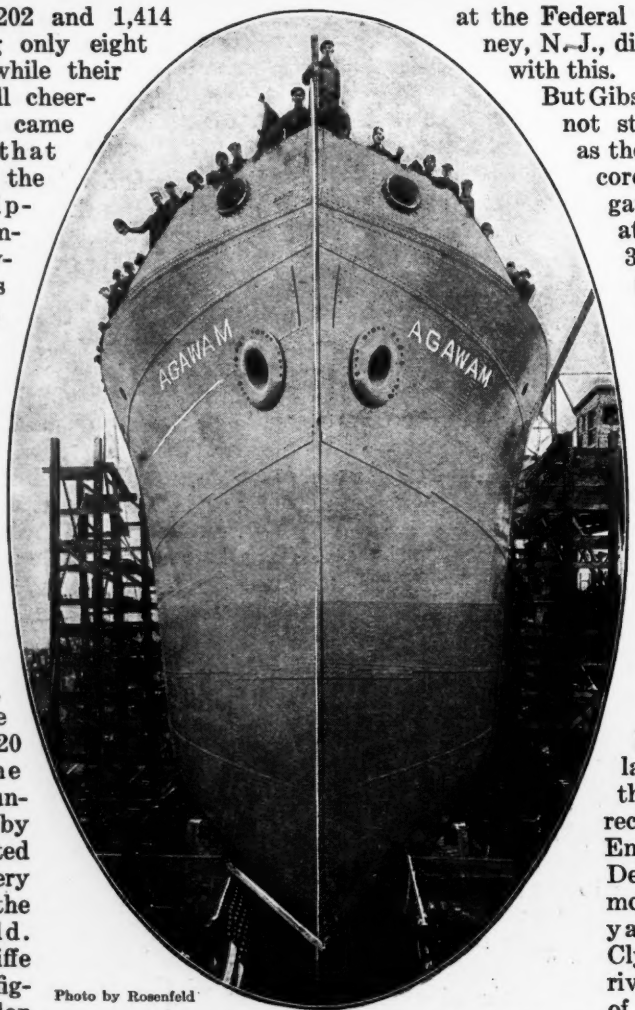
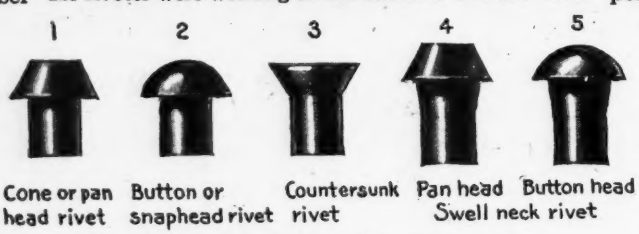


Photo by Rosenfeld

Look at her—studded with rivets, half a million of them for every similar standardized ship of 5,500 tons. If she were 8,000 tons, they would number nearly a million. Every one of them was driven home as if the riveter were working on the Kaiser's devoted head



Rivets Used in Ship Work

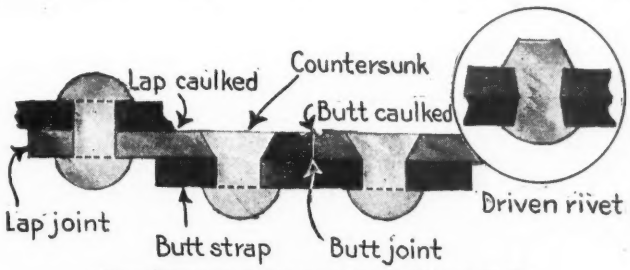
The three standard types of rivets used in ship work are the cone-head or pan-head rivet, the button - head, usually called "snap" rivet, and the countersunk rivet (Figs. 1-2-3). Figs. 4 and 5 show pan-head and snap rivets of the "swell-neck" type, used where the holes in the plates have been punched instead of drilled. Rivets are drop-forged from steel bars by automatic machines. The diameters of rivets most commonly used in ship work are ¾ in. and ⅞ in. The rivet hole is usually a quarter inch larger in diameter than the thickness of the plate

A Rivet Every 6⅔ Seconds

Meantime, however, Scotland had taken the international record away from England. Thomas Devine, at Reardmore's Dalmuir yards, on the Clyde, drove 4,422 rivets in the side of a ship in nine hours. This was the record beaten by Knight, whose performance still stands as the officially-certified high record, the Belfast figures of 12,209 rivets being regarded with much skepticism on this side of the water.

Knight's performance meant that

he drove 541 rivets an hour, or a trifle more than nine a minute, an average time of 6⅔ seconds to a rivet. Even at this high speed, allowing one-third of the time for shifting from one rivet to the next, the pneumatic hammer made it easily possible for him to strike sixty-five blows on each rivet-head, amply sufficient to set each rivet properly where water-tight joints were not required. It should be remembered that none of the remarkable records cited was made on water-tight work. Knight was working entirely on hatch strong backs, the built-up reinforcement around the hatch openings in a steamer's deck, where strength and rigidity are the essential requirements. On the parts of a ship that must be water-tight, such as the shell plating below the water-line, bulkheads separating water-tight compartments, etc., an average speed of 500 rivets a day is very good work. Ship plates are seldom planed, especially where speed of construction is necessary, and the riveter's skill is depended on to pull the lapped surfaces together, straightening out not only any warped places but taking care also of any buckling caused by the operation of riveting. This condition makes water-tight riveting necessarily much slower than work on other parts of the ship. In the United States Navy yards only hand riveting is permitted on this class of work. In rapid merchant-ship construction such as is now going on, seams are sufficiently caulked by means of the pneumatic caulking chisel, which "upsets" the edge of the overlapping plate and red lead and paint do the rest. In most cases this method of water-tightening is sufficient.



How Riveted Hulls Are Made Water-Tight

Cross-section showing how the two styles of plate-joints are caulked to make them water-tight. On lapped joints, which is the usual method of construction, the edge of the plate is "upset" as shown, by means of a caulking chisel, which is simply a cold-chisel inserted in place of the hammer head in a pneumatic hammer-tool. This is run along the edge of the plate, striking a thousand or more blows a minute, and expands the metal so that the joint is perfectly tight. Where two plates are abutted and riveted to a strap, the joint is caulked by running the caulking chisel along the adjoining edges of both plates.

In insert: Cross-section showing a pan-head, swell-neck rivet in place. The tapering hole is formed by the punching machine.

Halted a moment to have their picture taken, these drillers will soon have the little reaming engine going again

How a Championship Riveting Team Is Made Up

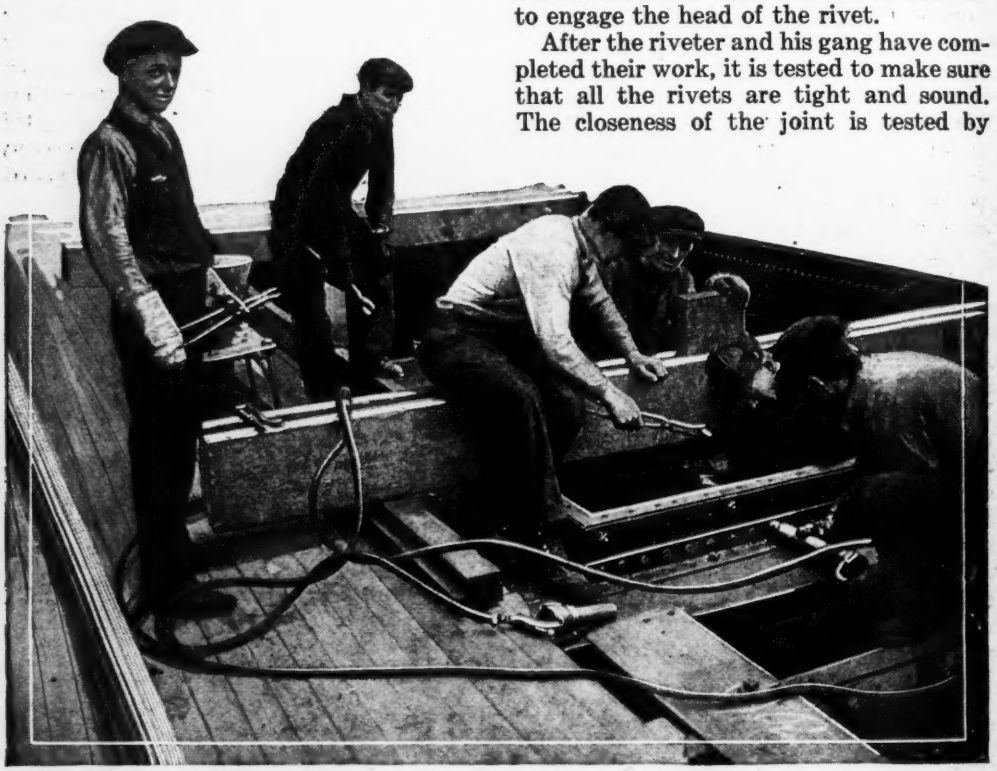
The riveting gang consists of the riveter, who handles the pneumatic hammer, the holder-on, or bucker-up, as he is sometimes called, who holds the head of the rivet while the riveter, on the other side of the plate, converts the point into a head, the passer-up, and the heater-boy. In the record-breaking teams the heater-boy is not a boy at all, but a full-grown and very expert man, who can keep a dozen rivets at a time heating in his little portable forge without letting any of them become too hot, and who tosses them with unerring accuracy to the passer-up at clock-like intervals.

No better way of heating rivets than the coke- or oil-burning forge has yet been found for ship work. For shop work electric forges have sometimes been found satisfactory, but the cost of running them is greater than that of running coke or oil forges.

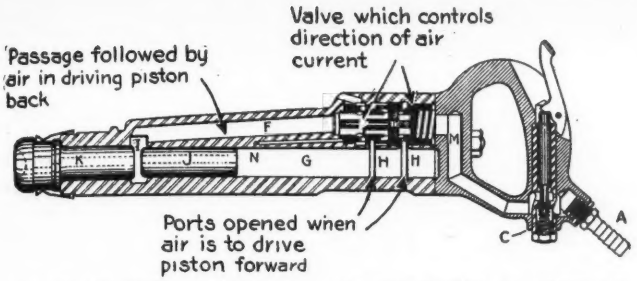
The passer-up has to be a skilful catcher of red-hot rivets (the proper temperature is just below white heat), and he must be apt and quick in inserting them in the holes. When it is difficult to have the furnace near the place where the riveting is done, the rivets have to be thrown sometimes a considerable distance. In such cases the passer catches the rivets in a keg or bucket. Seizing the rivet with his tongs, he inserts the red-hot rivet in the hole, and then prepares to receive the next rivet from the heater-boy.

The holder-on uses an implement called a dolly-bar to hold the rivet in place while it is being hammered. This tool varies according to the fancy of the holder-on and the space he has to work in. On water-tight work, where he has something to brace the tool, he may use a pneumatic dolly-bar similar in principle to the pneumatic hammer. More often, however, he uses either a sledge-hammer or a stout steel bar with a recess at the end to engage the head of the rivet.

After the riveter and his gang have completed their work, it is tested to make sure that all the rivets are tight and sound. The closeness of the joint is tested by



Team work—that's the answer to the "why" of riveting records. The "heater-boy," armed with the tongs on the left; the "passer-up," just placing a red-hot rivet in place, and the "holder-on" who is bucking the force of the driving pneumatic hammer, are as important in their way as the man on the business end of the hammer—but he gets the glory



In use the hammer (*K*) is held firmly against the point of the rivet. The hammer effect is obtained by repeated blows of the piston *J*, which is driven back and forth in the cylinder *G*, by compressed air at a pressure of from 80 to 100 lbs. The standard piston has a stroke of about 8 inches, in the size of hammer usually used in ship work, and strikes about 750 blows per minute. On some classes of work expert riveters use pistons as short as 1½ inches, and most of the high speed records have been made with shortened pistons, striking as many as 1,400 blows per minute.

Air from the compressor is led through a flexible hose to the hammer, at *A*. The trigger under the riveter's thumb operates the cut-off valve *C*. When air is admitted it passes through the channel *M* to the operating valve. With the piston in the position shown in the cross section, the air would travel through the channel *F* and enter the cylinder by the port *I*, forcing the piston back toward the handle end. As the piston passes the port *N* the ports *H H* are opened and the air is cut off from *F*. This drives the piston down on the hammer or rivet-set, the momentum being sufficient to carry it the full length of the stroke before the uncovering of *N* again reverses the direction of the air and sends it through *F* and *I* to drive the piston back again. The whole apparatus weighs about 25 pounds and is about 20 inches long

means of a thin-bladed knife, the insertion of which between the surfaces should not be possible. The rivets are also tested by the tapper, who strikes the head of each rivet lightly with a hammer. The tapper is so expert that he can tell by the sound whether there is any play between rivet and plate or not. Faulty rivets are cut out and new ones are put in their place. The rivets thus removed are carefully collected, and most of them are cut down to a smaller size, to be used on another job.

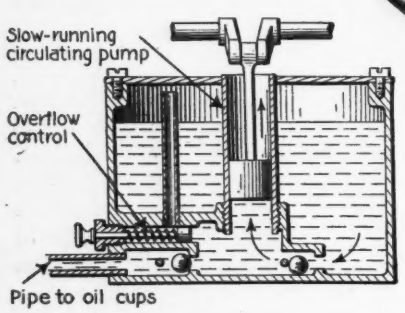
What Five Extra Rivets per Gang in an Hour Means

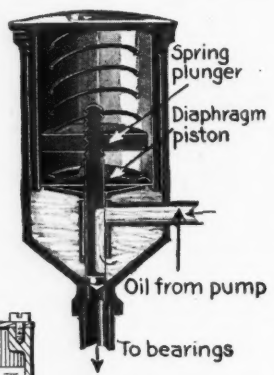
Although it is impossible for riveters working in close quarters, or on watertight work, to develop top speed, even this class of work has been speeded up in all American shipyards by the rivalry stimulated by the contests. Beckel's record of 1,511 rivets at the Staten Island yards, for example, was made with counter-sunk rivets, a much more difficult head to shape than the ordinary button-head rivet, and he was working part of the time in a position where the work was directly over his head. In the Staten Island yards the average for all classes of riveting was formerly 225 rivets a day for each gang. Since the contests began it has increased to 325. "Five additional rivets per gang per hour for all good men in good-sized shipyards means building one 10,000-ton steel freighter in ten weeks," says Chairman Hurley of the Shipping Board. The Board is trying to divert the competition into broader fields, making a month's work rather than a single day's burst of speed the basis for prizes and bonuses. Too many workmen want to drop their own work to watch the speed gang; the latter are too tired to work effectively for a few days after going after a record.

A championship contender and his "bucker-up" (the man who holds the rivet in place while the hammer pounds away) at work in the Submarine Boat Corporation yards where the first high speed record was made. When he is going good the din can be heard distinctly in Berlin thirty-five hundred miles away

Oiling Your Automobile Without Soiling Your Hands

INSTEAD of having to fuss with oiling your spring shackles, brake-rod connections, universal joints, etc., and get yourself oily and greasy into the bargain, why not make the regular oil pump of the automobile engine do the work automatically for you? This is what H. Hanna, of Sterling, Kansas, seeks to accomplish by the automatic oil cup illustrated herewith. The cup is really the feature of the apparatus, since it can be applied to any car with a force-fed lubrication system as shown in the pictures. The cup is of the dual type with one cup inside the other, the inner cup being provided with a piston and piston rod and a coil spring behind the head of the piston to force it down automatically and squeeze the grease into the bearing to be lubricated.





The pump to the left supplies the oil to the oil cups (above) and the spring plunger does the rest

The piston rod has a groove cut into it near its center to act as a valve to admit the grease as soon as the spring has forced the piston down until the cup is nearly empty. As soon as sufficient grease has been forced into the cup, the piston is moved up in its cylinder to close the valve, after which the lower end of the piston rod acts as a plunger to force the lubricant down into the nozzle of the cup screwed into the bearing to be lubricated.

This method of oiling is not only more cleanly but also more economical than the old one.

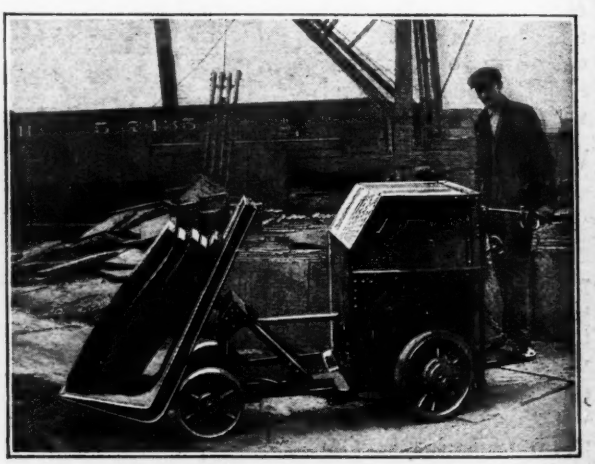
Concrete Ships Contain Forty-Two and One-Half Per Cent Steel

IT has been figured out that in ships built of reinforced concrete the weight of steel is about 42½ per cent. of that in a steel ship. This estimate is based on a ship 205 feet long, 32 feet beam and 19½ feet draft.

How Slabs Are Hauled by Electricity

ONE of the recent devices designed to save man labor is the slab-handling storage battery truck, which is employed at the plant of a steel company in Cleveland to haul heavy pieces of steel from the storage yard to the heating furnaces. The distance approximates five hundred feet. Before electricity was substituted for man-power the slabs were loaded on hand-trucks.

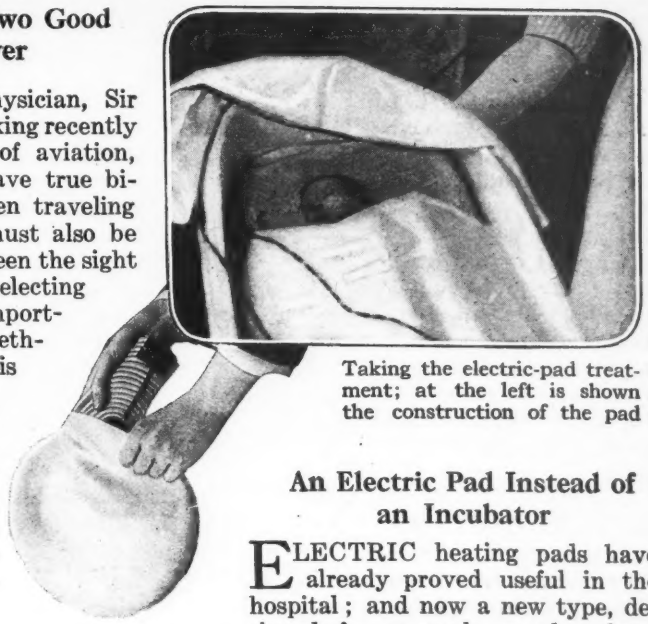
The new truck is similar to the elevating platform truck, except that for its elevating mechanism a tilting platform is provided. This platform is secured to the rear axle by a pivot, being operated by a horizontal ram. By manipulating the ram the platform is moved toward a vertical position and its front edges are lowered.



This truck was designed to take the place of muscle in hauling steel slabs. It is electrically-operated

Why You Must Have Two Good Eyes to Be a Flyer

A FAMOUS English physician, Sir Watson Cheyne, in speaking recently regarding the medical aspect of aviation, says that an aviator must have true binocular vision, especially when traveling at great speed, and there must also be a very rapid connection between the sight and the action. In fact, in selecting pilots, one of the most important points to ascertain is whether the binocular vision is good and also the time it takes between the aviator's seeing and taking action. Very often it has been discovered that one eye is not used at all. Many people are going about with one eye and not using the binocular vision.



Taking the electric-pad treatment; at the left is shown the construction of the pad

No More Fumbling in the Dark for That Key

HOW many times have you fumbled in the dark for the door key, fingering over half the bunch on your key-ring, picking out the wrong one and burning up a lot of energy in foolish impatience? That has been the common lot of key-bearing humans, but it does not need to be now, since there has been placed on the market a key-ring with a special section for the most used key.

With this ring you can find at once, even while you are drawing the keys from your pocket, the one that you most often need. The ring is so made that keys may be quickly put on or removed from either the special section or main ring.

Had this invention been given to the world when men first began to lock their doors, the saving in time would have amounted to enough to make efficiency engineers wonder as well as emulate.

You don't have to finger over half the bunch on your key-ring to pick out the right key. The most used key is kept in a separate section

An Electric Pad Instead of an Incubator

ELECTRIC heating pads have already proved useful in the hospital; and now a new type, designed for general use, has been put on the market. It is a modification of the hospital type of pad, and contains a thermostat in a sealed box and wound with the continuation of the German silver wire that forms the main heating element. The thermostat heats with the pad, remains at the same temperature, and is therefore independent of radiation for its action. The thermostat, in the center of the pad, is composed of two U-shaped arms of half yard brass and tempered steel. It is adjusted through a slot in its container and has a range from 100 to 180 degrees. There is no danger of short-circuiting even when the pad is wet. A pad of this description has been used in cases where a baby incubator was not available to keep a baby that had been prematurely born comfortably warm for several weeks, with the thermostat set for 100 degrees.

Electric heating pads are made in several sizes for various purposes as needed.

You Can Sight a Camera Like a Rifle with This Finder

MR. C. C. CARPENTER, of Akron, Ohio, has invented a lensless direct view finder which is easily attached and which enables the operator to see his object right up to the moment of exposure.

The new finder is merely a half-cylinder about an inch in diameter, with no lens, attached directly over the lens of the camera to the body of the camera by a tongue and loop. The correct distance for the exposure is obtained by the regular finder or by the focusing scale. Then the object is centered by squinting through the direct finder after the fashion of a gun sight. In this way expressions can be caught, and poses obtained that would be impossible with the regular finder.

With this direct view finder you can see your object up to the very time of exposure

A Secret Organization Builds a Clubhouse of Driftwood

THE Arctic Brotherhood, whose home in Skagway is shown in the accompanying illustration, is a secret society the rules of which permit the formation of a "camp," or lodge, only north of the parallel 54 degrees 40 minutes, the southern limit of Alaska. Under this rule there can be no initiation of new members except in the far North. Nearly every eminent man who visits Alaska, however, is initiated. Among the members are Rex Beach, former Speaker Cannon, and ex-President Roosevelt. The brotherhood was formed at the time of the Klondike gold fever, when there was more or less trouble between the Americans and the Canadians. The organization maintains camps at Sitka, Fairbanks, Nome, Dawson, White Horse, Skagway and other points.

What Is the Color of a Smell?

CAN we say that a thing has a "green odor," or a "pink smell"? Professor R. W. Wood of Johns Hopkins thinks so. It seems that colors bear a certain relation to odors. This is especially true of gases. Bromine and peroxide of nitrogen, for instance, are both reddish-brown in color, and although chemically different they affect the sense of smell in the same disagreeable manner. The air we breathe is composed chiefly of nitrogen and oxygen, two colorless and odorless gases. But if these two elements are combined in the proportion of two molecules of nitrogen to four of oxygen the odor becomes so unpleasant that we should call it "dark brown" when expressing it in the terminology of colors.

Home of the Arctic Brotherhood in Skagway. The building's ornate front is made of driftwood

This Machine Will Make the Most Fractious Fraction Behave

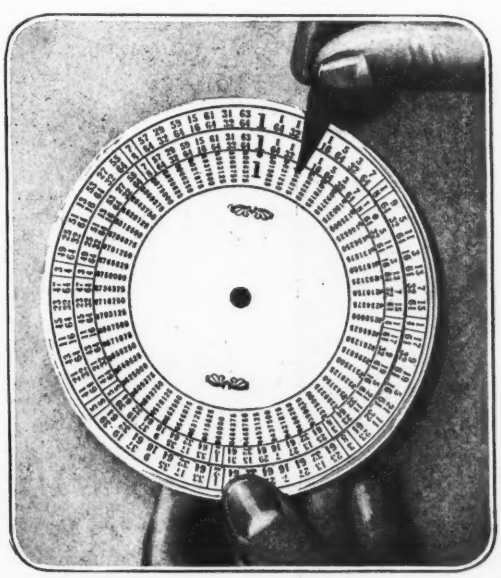
LIFE is to be made easier for accountants and draftsmen by the invention of a device that will add and subtract fractions with a minimum expenditure of brain power.

The device consists of two superimposed disks, one smaller than the other, pivoted at their centers. Two scales of fractions from 1/64 to 63/64 are spaced around the peripheries of the two disks. On the smaller disk, inside the fractional scale, is a row of holes, one for each scale reading, and inside of the holes is a scale of decimal figures which are the decimal equivalents of the fractions.

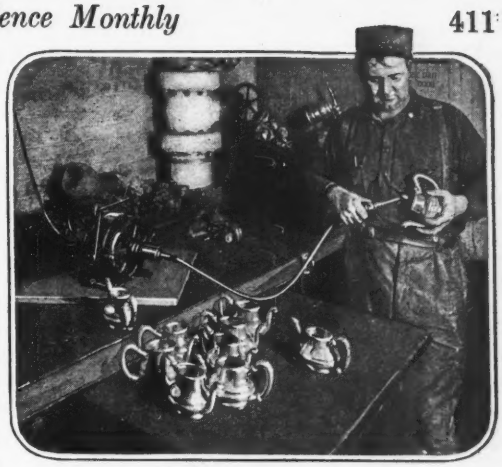
If, for instance, it is desired to add the fractions ⅛, 3/16, 7/64 and 11/32, the first step is to bring the 1's on both disks in line and then place the point of the pencil in the hole under ⅛ on the inner disk and bring it under 1 on the outer disk. Next place the pencil point in the hole in the inner disk, opposite the fraction 3/16 on the outer disk, and bring it under 1 on the outer disk. Repeat this operation for 7/64 and 11/32, and under 1 on the outer disk you will find the answer, 49/64, on the inner disk. Directly below it you will also find the answer in decimals, 0.765625.

In cases where the fractions added total more than 1, the whole number part of the answer is had by observing how many times the 1 on the inner disk has been moved past the 1 on the outer disk. Fractions are subtracted by reversing the method for addition, and combined addition and subtraction by combining the two methods.

The operation of the disk is so simple that a child can do it.



You may be the poorest of mathematicians, but the toughest problem in fractions is easy if you have this little disk



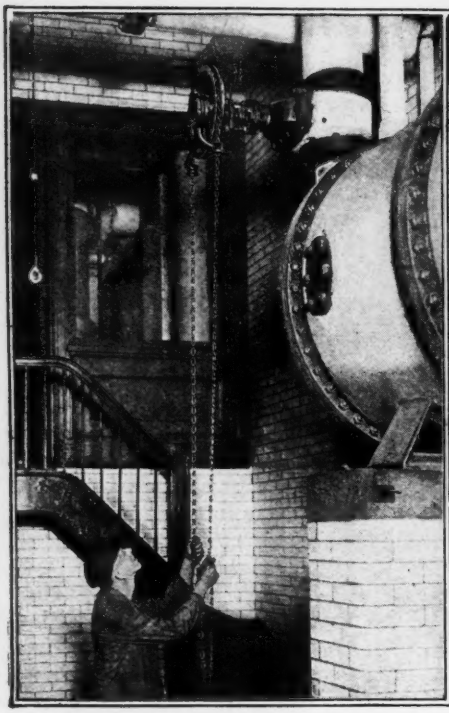
Meet Mr. A. L. Barth, whose job in life is to massage out wrinkles in the dining-car silverware of the Union Pacific Railway

Removing the Dents Caused by a Fast Life

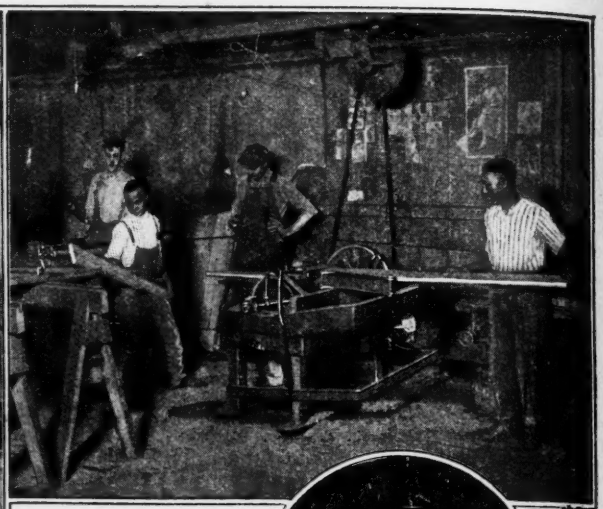
THIS is a silverware hospital with A. L. Barth as surgeon. He is called a repair man instead of doctor; his operating room is the Union Pacific Railroad's repair shops at Omaha, and his patients are the silver pots and bowls bearing the dents and scars of their strenuous dining-car life. How to make them presentable was a problem until someone hit upon the idea of an electric hammer with a small, rotating, oval head. Applied lightly to the dent on the inside, the hammer, in skilful hands, rapidly massages away the hurt and leaves the outer surface without a mar.

A recollection of the juggling feats of the colored waiters leads us to believe that the silver repairman seldom has to complain of lack of business, though we are not told how often the railroad silver has the rest cure.

Do It with Tools and Machines

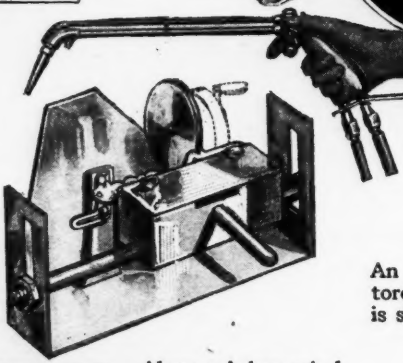


Valves placed in pipe lines overhead in inaccessible places may be easily operated with this rim and chain from the floor below



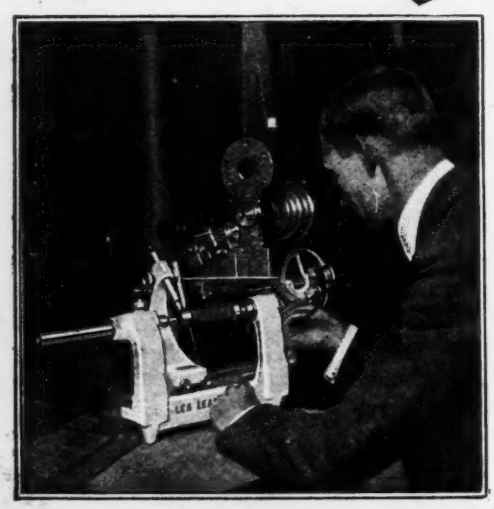
Both edges of a board may be glued at the same time for making table tops and other things

A single unit steel-jacketed electric heater that can be installed single or in multiple in narrow confined places



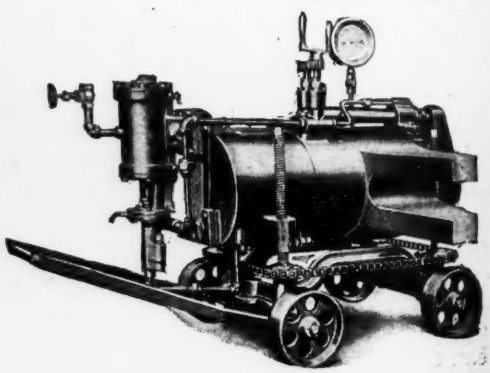
An oxy-acetylene welding torch controlled by one hand is shown above, to the left

Perfect threads are essential to the accuracy of fine machinery. Below is shown a micrometer thread-lead gage that measures and detects the slightest bit of inaccuracy

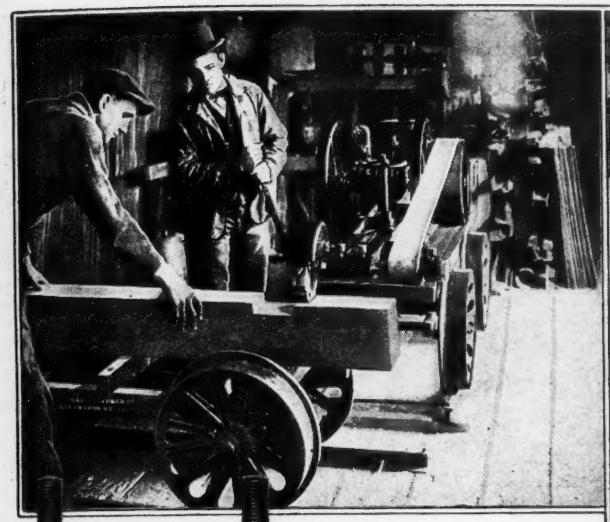


Above: A key grinding rig in which the master key guides the grinding wheel

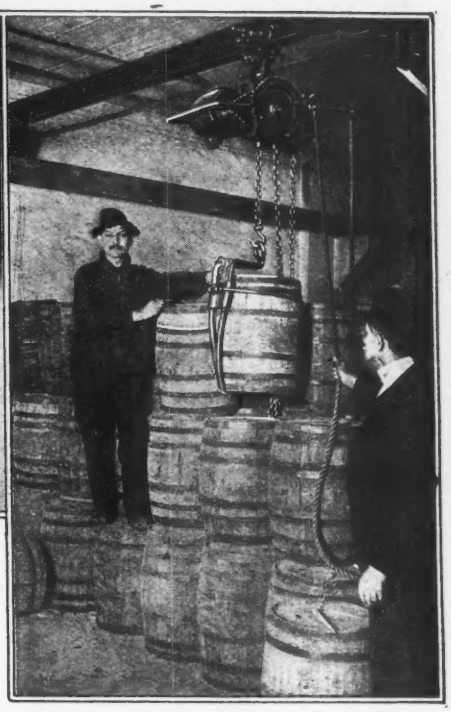
Below we have a portable press for forcing crank pins into the wheels of locomotives and of engines



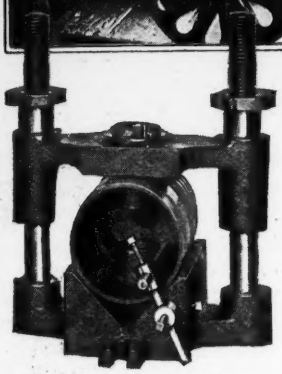
Do It with Tools and Machines



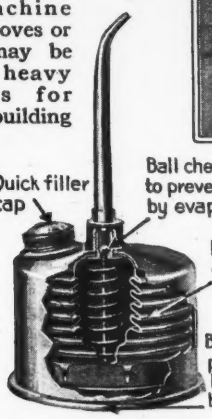
With this powerful machine large grooves or dados may be cut in heavy timbers for bridge building



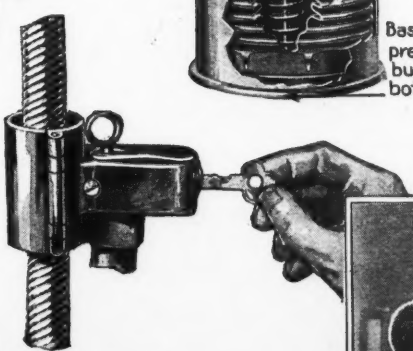
An electric hoist with a special hook or grip to handle heavy, unwieldy barrels in storing or loading



A jig to hold a piston in boring and reaming for wrist pins


Quick filler cap
Ball check valve to prevent loss by evaporation
Expanding and contracting ribs
Base of ribs pressed in by button on bottom

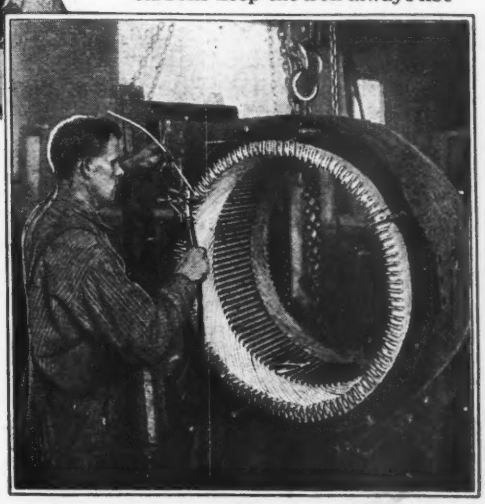
The metal bellows oil can, shown in center, draws the oil in after the squirt



At the right, a clamp and lock for an elevator control cable

An electric soldering iron is shown – below in which two carbons keep the iron always hot

A three-wheeled shop truck in which the leading wheel can be used with other trucks



Making the Safety Zone Post Resilient and Safe

AFTER his auto had bumped a few safety zone posts, resulting in disfigurement of both post and car, Stanley Kempner, of New York city, hit upon the idea of using rubber in place of iron for the post rods. In his invention the base of the zone post is iron, as in the ones commonly in use, and the plate—where one is used—bearing the "Safety Zone" sign, is also of metal, but the connecting rod is of hard rubber. When the post is hit the rubber rod bends, only to snap silently back into place again when the offending car has backed away, and neither car nor post is the worst for the accidental encounter.

If this were a rubber post instead of an iron one neither car nor post would get much of a shakeup from the collision

Mr. Kempner believes that the general adoption of his post would decrease the number of street accidents, since drivers would be quicker to risk running into the posts when facing the alternative of hitting a post or a pedestrian.

Twenty Miles an Hour Is the Most Economical Touring Speed

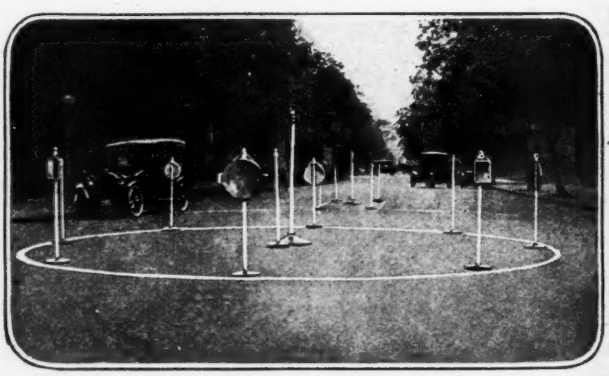
AS the automobile touring season is now in full swing it may be well to remind the autoist of the proved fact that the most economical touring speed is from twenty to twenty-five miles an hour. Fast driving on tours means increased fuel consumption, greater strain on the car and its occupants as well as lower mileage. Moreover, the Government, desirous of conserving gasoline for war purposes, discourages extended pleasure tours; so that not only the motive of thrift, but also of patriotism, should urge the speed maniac to slow up.

Washington May Get Along Without Traffic Policemen

TO avoid congestion at busy street crossings in Washington, D. C., a new system of "rotary traffic" has been adopted. The purpose of it is to prevent any "left turns," and automobiles must go around the circle marked on the pavement, when they want to shunt off in that direction.

The entire crossing is plainly marked out with this rotary scheme, circles and straight lines being laid out in geometrical fashion to indicate where motor cars and pedestrians are to move. Small arrows are part of the scheme and no driver has any excuse for not knowing the rules. All he has to do is to keep his eyes on the ground.

These crossings are further decorated by a series of sign posts, placed at each intersecting point of the lines on the street. These set off the points of contact of the circles and the straight lines. This system has been found to operate very successfully, even without the supervision of a traffic policeman. It has been quite generally adopted throughout the capital city, where wide streets and numerous parks contribute to its success.



No policeman is necessary to prevent traffic tangles at Washington crossings guarded by these silent monitors

Caring for the Teeth of Our Soldiers

Because an army fights with
its teeth as well as with bullets

"Do I have to eat the Germans?" asked the recruit who was rejected because of bad teeth in the early days of the war. Now the army takes him and repairs his biting machinery

FOR the first time in history the American Government has assumed supervision and control of the teeth of the Army and Navy. In full recognition of the importance of sound teeth the military authorities pay careful attention to the condition of the teeth of the volunteers and drafted men who present themselves for examination as to their fitness. Men with hopelessly bad teeth are rejected and those with less serious defects are turned over for repairs to the dental department. When soldiers were expected to bite off the ends of their cartridges and when soldiers and sailors alike were expected to subsist principally on "hard tack," it used to be the policy of the Government to reject men with poor teeth from army and navy, but no effort was then made to correct minor defects and to keep the teeth of the men in good condition.

A man without teeth or with teeth that are decayed or otherwise defective cannot chew properly. He is a mark for indigestion. Moreover, his decayed teeth may harbor germs, the presence and activity of which may produce diseases of a serious nature. But, if we must have an army, it should be efficient. It does not pay to maintain an inefficient army. For that reason it is good policy for the Government to assume parental care of the teeth of its soldiers and sailors.

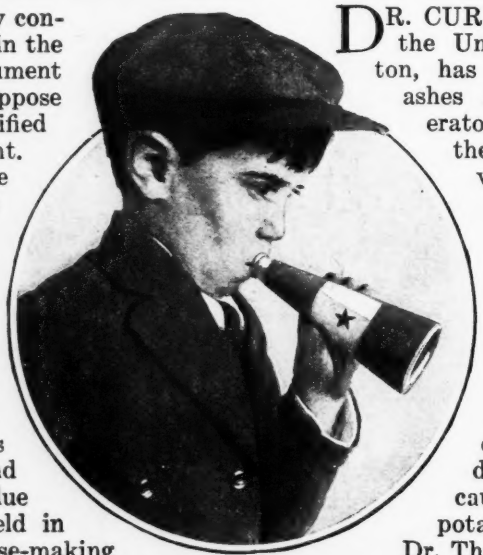
In the big camps where recruits are prepared and trained for service at the front, dental departments have been established. The large dental hospital at Camp Meade, Md., is typical. It is a large, plain structure of wood, with double walls, large windows and adequate ventilation. It is supplied with running water and electric light and power. The apparatus is of the most modern kind. Chairs, rests, trays and other parts of the equipment are of metal coated with white enamel, or of glass. Electric motors supply the power for the drills, polishers and other rotary instruments. By the side of each chair is a white-enameled cabinet containing a full assortment of medicines and dental instruments and supplies.

The teeth of the recruits are carefully examined from time to time, and if they show any defects the men are sent to the dental hospital where these defects are promptly remedied.

Blow Your Megaphone-Whistle to Proclaim Your Patriotism

AN Eastern novelty concern has placed in the market a new instrument of torture. We suppose that it must be classified as a musical instrument. It is a megaphone whistle which sounds both "coming and going," like the reeds of a mouth harp. It will produce noise enough to satisfy the most patriotic youngster.

The surface of the megaphone cone is colored red, white and blue, and shows a blue star in the white field in token that the noise-making youngster has some member of his family in the service of his country.



It is a megaphone-whistle that sounds both "coming and going" like a mouth harmonica

How Can We Save Potash Now Wasted in Smoke?

DR. CURTIS H. THWING, of the University of Washington, has been examining the ashes found in the incinerators of lumber-mills in the Northwest, with a view to conserving the potash salts from them. He found that the flue dust contained only about seven per cent of potash. The reason for this slight proportion was that the type of incinerator in use calls for a strong draught, and this causes much of the potash to go off in smoke. Dr. Thwing did not see how the present incinerators could be improved with the present methods of lumbering.

The amount of wood that goes to waste in the lumber industry is a scandal; but, until we have worked out ways of using the vast waste of sawdust, small branches, and slats, there is no use blaming the lumberman.

Change the Electric Light Bowls to Suit Your Taste

SOMETHING new in electric light fixtures has been placed upon the market, that will greatly please women, who often wish to change the color scheme of a room, perhaps for one evening. This, of course, includes the light globes, and new globes are expensive.

The invention referred to and illustrated here makes it a simple matter to change the color or decoration of the light bowl. In the new device there are two bowls, one inside of the other, held together by a brass rim. Silk or any other kind of material, colored or decorated to suit the taste, may be placed between the two bowls, so as to bring the fixture in harmony with the color scheme or the decorative plan of the room. The new fixture is made with bowls of different shapes and styles to furnish the variety that is the spice of life.

Place the material over the inner bowl. Cover with outer bowl and clamp the rim

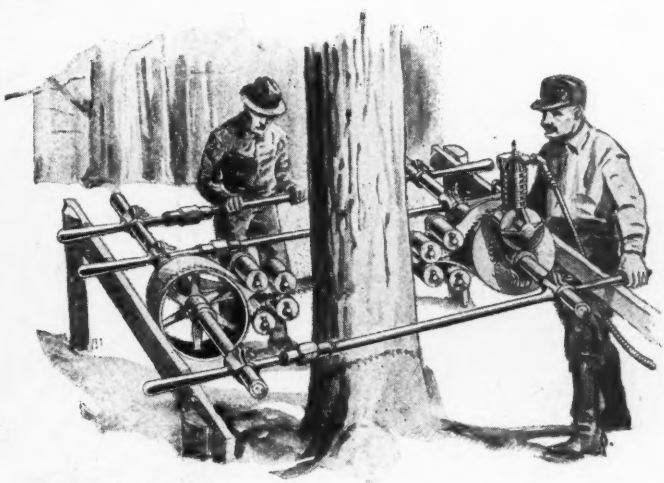
Good-bye, Axe! They Chop Down Trees with Gasoline Now

AN automobile truck comes to a stop among the big timber. Two men lift a heavy framework of iron rods and pipes from the truck, while two other men drive four stakes at equal distances around the base of one of the giant trees and connect each pair by nailing planks to them at a height of about two feet. The iron framework is put together, fitted around the tree and placed on top of the parallel planks. Then an arrangement of wheels and rollers is put in place and adjusted, and finally an endless steel bandsaw of peculiar construction is placed around the wheels and between the rollers. The wheel on one side is connected with a gasoline engine and when everything is in readiness the engine is started going.

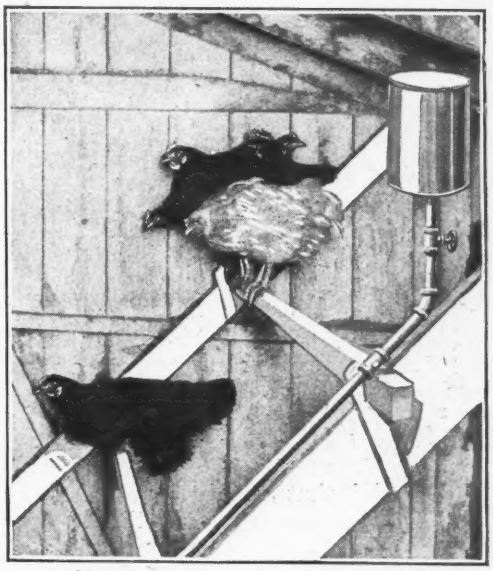
The wheels begin to revolve, and as two of the men slide the frame towards the tree, the rapidly moving saw begins to scream while its teeth cut into the wood. In a few minutes the work is completed.

That's the new way of felling trees with neatness and despatch.

The accompanying illustration shows the construction of the sawing device. The teeth of the saw are all "set" to one side, but the divergent "set" required for cutting is obtained by combining the upper and the lower runs of the saw.



The husky wielder of the axe gives place to the engine-driven bandsaw; the work of half an hour is done in a few minutes



Vermin-proof perches are the up-to-date improvement for hen houses

Making the Perch Sanitary for the Hen

HOW to make hen houses vermin-proof has been solved by a Michigan man who has invented a hollow perch containing germ-killing disinfectants which seep through and destroy all hen-troubling pests. The perches are connected with a gravity supply tank holding a gallon of the disinfectant and each perch has a dripping plug to regulate the flow.

What Makes an Airplane?

INCLUDED in the materials necessary for one airplane are: Nails, 4,326; screws, 3,337; steel stamping, 921; forgings, 798; turnbuckles, 276; wire, 3,262 feet; aluminum, 65 pounds; spruce, 244 feet; pine, fifty-eight feet; ash, thirty-one feet, hickory, one and one-half feet; varnish, eleven gallons; dope, fifty-nine gallons; rubber, thirty-four feet; linen, 201 square yards; veneer, fifty-seven square feet.

Breakfasting on Poi

It is made from taro and has been the food of primitive people for centuries

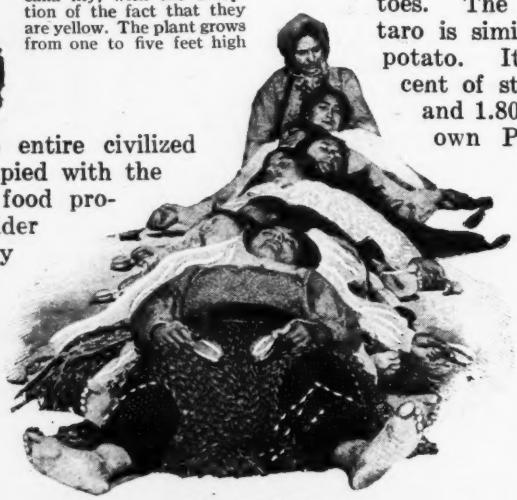
By A. M. Jungmann

The Taro Plant

Taro plants are not grown from seeds. In fact, the plant produces flowers rarely. The flowers, when they do appear, resemble the calla lily, with the exception of the fact that they are yellow. The plant grows from one to five feet high

NOW that the entire civilized world is occupied with the question of food production, let us consider taro, perhaps the very first crop raised. Taro is a plant that grows wild in Polynesia, the Malay Archipelago, and India. The very earliest of those daring European navigators who voyaged on untraversed seas found taro cultivated from Japan to New Zealand.

The taro root is very like the yam, or sweet potato. Besides being made into poi, it is frequently used as we use potatoes. The nutritive value of taro is similar to that of the potato. It contains 18 per cent of starch, 1.75 of sugar, and 1.80 of protein. In our own Philippines, modern factories turn taro roots into "poi." Wash the taro roots and then grind them into powder and you have poi. The meal is a delicate pink or lavender color. It is not only highly nutritious, but is so easily digested that it is an ideal food for young children or invalids. It is an



Poi-Eaters' Dance

The dancers, after eating poi, sway back until they are reclining on the floor, then sway forward again

This Is How Taro Grows

Hawaiian taro is planted somewhat as we plant potatoes—that is to say, in hills and rows. The rows are placed from one to three feet apart, and a small ditch is run between every five or six rows in order to keep the moisture of the earth uniform. These ditches are filled with water after the taro has been planted several days. The taro itself cannot be flooded, because, if a patch is flooded too soon, it is likely to rot

excellent substitute for cornmeal, farina, and other cereals. In the tropics a porridge is made of poi by adding the meal to hot water and stirring it constantly until it has the consistency of paste. It may be eaten with salt or sugar, butter or syrup. It would undoubtedly be welcome on American breakfast tables, if eaten with cream like other cereals. In the Far East taro roots are cooked and eaten like potatoes, or diced and baked with rice flour.

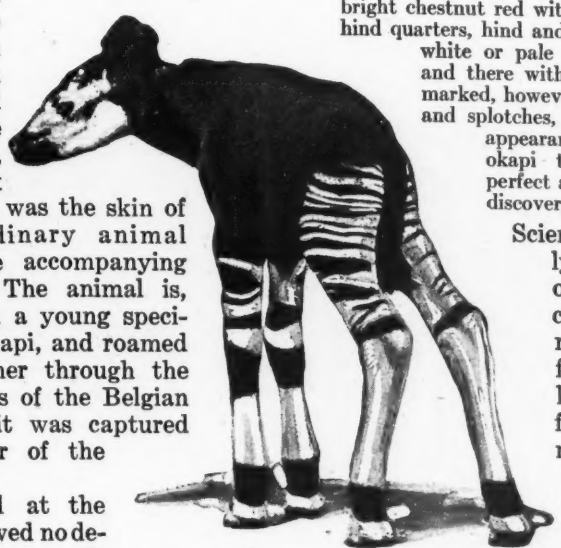
The Poi-Pounder, Showing Primitive Method

When the harvest has been gathered, the taro is boiled for several hours. When it has been boiled sufficiently it is placed in boat-shaped trays and beaten with a stone implement known as a poi-pounder. It is necessary to moisten the taro during the process of pounding. This is done by moistening the stone-pounder. When the substance is of a dough-like consistency, it is called paiai. This is pounded again, a little water added, and the pounding continued until the substance becomes fine and smooth, when it is poi

The Okapi's Coat Outshines Joseph's Coat of Many Colors

ONE of the most precious trophies which Mr. Herbert Lang, of the expedition sent by the American Museum of Natural History to the Belgian Congo, brought back to New York, was the skin of the extraordinary animal shown in the accompanying illustration. The animal is, or rather was, a young specimen of the okapi, and roamed with its mother through the tropical forests of the Belgian Congo until it was captured by a member of the expedition.

It remained at the camp and showed no desire to run away. It did not live long, however, and died after two weeks, to the general regret of the members of the expedition.



This creature, which looks like a composite of half a dozen different animals, is a young okapi imported from the Belgian Congo

The first white man who had the good fortune to see a living okapi in its native habitat was Sir Harry H. Johnston, Special Commissioner for Uganda, British East Africa; and he gave the first detailed description of that rare animal:

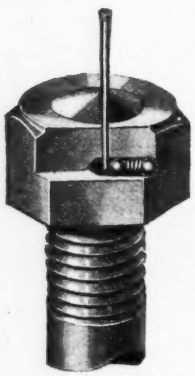
> The coloration of the okapi is quite extraordinary. The cheeks and jaws are yellowish white, contrasting abruptly with the dark colored neck. The forehead is a deep red chestnut. The large, broad ears are of the same tint, fringed, however, with jet black. The forehead ranges between vinous red and black in tint, and a black line follows the bridge of the nose down to the nostrils. The muzzle is sepia colored, but there is a faint rim or mustache of reddish-yellow hair round the upper lip. The neck, shoulders, barrel, and back range in tone from sepia and jet black to rich vinous red. The belly is blackish, except just under the knees. The tail is bright chestnut red with a small black tuft. The hind quarters, hind and fore legs are either snowy white or pale cream color, touched here and there with orange. They are boldly marked, however, with purple-black stripes and splotches, which give that zebra-like appearance to the limbs of the okapi that caused the first, imperfect account of it to indicate the discovery of a new striped horse.

Scientists have been greatly interested by the okapi, and have decided that it is closely related to the giraffe family, but really belongs to a separate family, which they have named *Okapia*.

Those who have seen the okapi in its native habitat, roaming in the underbrush, assert that its protective markings make it difficult to distinguish the animal.

Use a Nail to Unlock the Nut of This Bolt

THE nuts of screw bolts used on high-speed machinery invariably have a tendency to work loose. No matter how well they are made and how tightly they are screwed down, continuous vibration will sooner or later loosen them. Unless their looseness is ascertained in time and they are tightened again, the nuts may work loose altogether and the dropping out of the bolt may wreck the machinery. Many devices have been invented for locking nuts in position after they have been tightened, but few of them have given satisfaction.



The harder you try to unscrew this unique nut the tighter it becomes

Recently a manufacturing concern in Detroit placed in the market a remarkably clever device in the form of an automatically locking nut. Into the side of the nut a hole is drilled obliquely toward the inside thread, so that a slot-like opening is formed. A specially hardened steel ball, backed by a spring, is inserted in the drill hole, which is then closed. When you try to unscrew the nut, the steel ball, which is pressed against the thread of the bolt by the spring, is wedged in the thread and tightens the nut to absolute immovability. To unlock the nut, a finishing nail is inserted in a small hole that runs at right angles to the groove in which the locking ball moves. A slight tap on the head of the nail will release the wedged steel ball and hold it away from the thread. The nut can then easily be removed.

The construction of this nut, which is made in all standard sizes and threads, is extremely simple. There are no loose parts that could be lost or that would easily get out of order, and it works perfectly.

Fitting the Gun to the Man Who Shoots It

IF you are particular you had better get measured for your gun. The "try-gun" shown in the pictures below was invented for that very purpose. It is made with joints, screws, and bolts that permit you to change the length of stock, the "drop," and the "cast-off" as you choose. This one is the product of a celebrated American gunmaker and is the most highly developed of its kind. Here's what the fitter can do in making the gun exactly to your measure:

Increase or decrease the length of stock; alter the "drop"—the distance of the stock below the line of sight or top of barrel—at both comb and heel; change the "cast-off"—the lateral departure of the stock from the line of the bore of the gun; and change the pitch of the butt plate—the distance from trigger to heel and to toe of butt plate.

On one day at the traps this gun was used by a man who required its utmost length of stock—15½ in.—and another, a less husky gunner, who shortened the stock to 13½ in. Neither man knew just what he wanted or needed until he had gone through the fitting process.

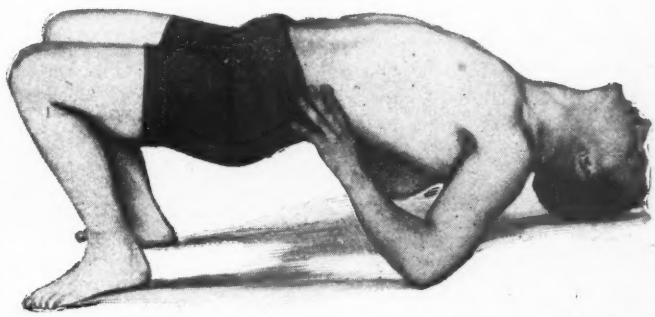
Heine Pfirrmann, Jr., a noted California trap-shot, tried out the "try-gun" and found he could get a perfect fit

By simply shifting screws in the stock of this "try-gun" you can fit it to your needs as closely as the tailor fits your coat

A Beetle That Does a "Flip"

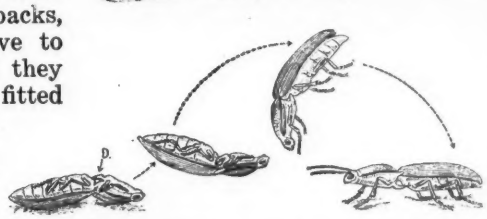
Alaus oculatus would be a great circus performer

By Dr. E. Bade



A circus performer could never perform a "flip" if he were required to start from this position

THE beetles of the Elateridae family are distinguished by their comparatively short legs. This is a handicap, for they cannot right themselves with their legs, as other beetles do when thrown on their backs, and they would have to remain lying where they fell if they were not fitted with a peculiar jumping device by which they right themselves.



A beetle doing its great jumping act. The acrobat's effort is tame in comparison

When the beetle is tumbled over on its back its first attempt is to get into contact with some object immediately above with its short legs. Failing in this, the beetle arches its back so that only the neck-shield and the wing covers touch the ground. Then a slight click is heard, the beetle hurls itself upward, turns over in midair, lands on its feet, and goes on its way.

When the back is arched only the front part of the neck-shield and the back part of the wing covers touch the ground. Looking closely at the beetle, we find a thornlike projection growing from the middle of the ventral side and attached to the first abdominal segment tightly pressed against the rim of a depression found on the second abdominal segment. When the muscles of the body are suddenly contracted the thornlike projection slips with a sharp click from the rim into the depression. By this action the abdomen is thrown upward with such force that the beetle is lifted bodily into the air.

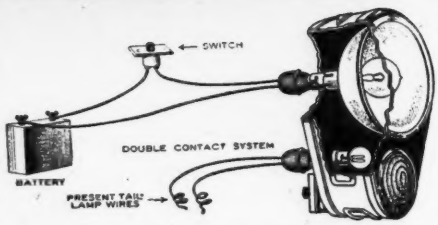
This is the jumping beetle, otherwise alaus oculatus

A few beetles of the Elateridae family (of which more than 3,000 varieties are known) have been known to jump more than one foot in this manner, and they seldom fail to land on their feet. Should the first attempt fail the jump is repeated until it is successful. So you see the Elateridae family might be billed in the circus any season—name and all—for by comparison the "mat work" of the human performer is tame indeed. To be sure the circus tumbler can lie at full length and then "snap up" to his feet, but he couldn't do it if he were required to start from a position with head and heels touching the mat.

The larvae of the larger Elateridae prefer to live in the wood of dead or decaying trees. The smaller varieties devastate whole fields of potatoes and other vegetables, as well as destroy grain of all kinds.

The large and beautiful jumper alaus oculatus is an inhabitant of the Eastern States, and is found during the months of July and August. The whole body of the beetle seems to be covered more or less with a white powder. On the cephalothorax are two large, round black spots fringed with white.

A searchlight in the rear of the car is very useful in a case like this. The wiring is simple



A Tail Light and Searchlight Too

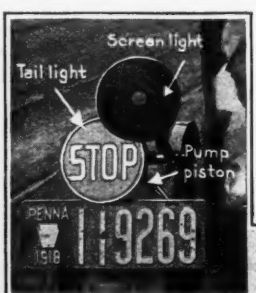
MANY accidents which happen to automobiles when backing up at night could be avoided if every car were equipped with the new combination of tail light and searchlight shown in the accompanying illustrations. It contains in one casing a regulation red danger signal and above it a powerful searchlight electrically controlled from the driver's seat. The device was invented as the result of a car's backing down a road embankment at night in an endeavor to turn around. Besides eliminating accidents of this nature by throwing a flood of light behind the car, it is also just as useful when backing into a garage door or against a curbstone, for which contingencies it is almost as necessary to have lights behind as in front when going forward.

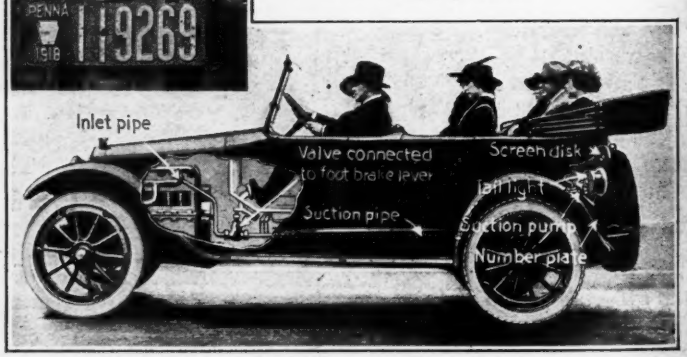
The lamp may be wired for either the single-or double-contact system, and is very simply constructed as shown in the drawing.

"Stop!" It Shouts to the Car Behind

THE rear automobile signal device shown in the illustrations below is automatic in action and is manipulated through the suction of the car engine, as the brake pedal is depressed to slow down or stop the car. The signal consists of a ruby red tail light with the word "Stop" in white letters and a circular black disk with a small hole at its center.

Ordinarily the disk covers the word "Stop," the red light showing to cars behind through the hole in the disk. The disk is mounted on a small rod fastened to the connecting rod of a small suction pump mounted behind the light. This pump is operated by connecting a small three-sixteenth-inch pipe between the intake manifold of the engine and the pump. The pipe is fitted with a valve near the brake pedal, so that each time the pedal is depressed the valve is opened, creating suction in the pipe. This sucks the pump piston to the end of the stroke, thereby pulling the disk from in front of the light and uncovering the word "Stop" to be read by occupants of following vehicles.





When the car slows up or stops the "Stop" signal is automatically displayed to warn other vehicles

Meatless Meals for Men Who Handle Meat

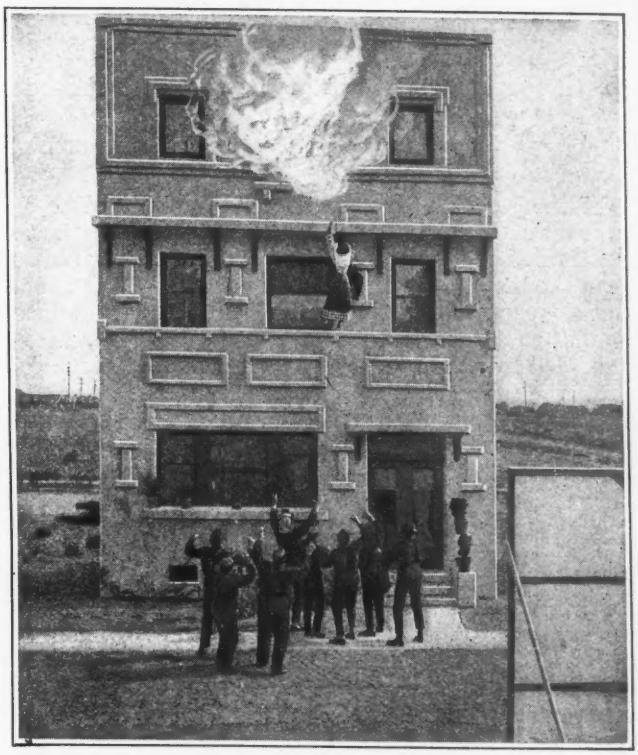
ACCORDING to a bulletin issued by the Food Administration, meatless luncheons are now served in the employees' dining room of one of the largest meat-packing concerns in the Chicago stock yards. Between 1,200 and 1,500 people are served daily, the menus including eggs, fish, oysters, mushrooms, cheese, milk, ice cream, beans and other proteid foods, together with a wide range of fruits and vegetables.

The Ground Floor Becomes Second Story

THE owner of a one-story frame house in Waco, Texas, desired to add another story. He found that a large part of the cost would be the expense of tearing off the roof to add another story, and rebuilding the roof. To save this expense—and also time—he had the entire house raised some fifteen feet off the ground and built the new story underneath. A slight change in the floor plan of the old house converted it into the second story of the new one.

You'd never guess that the house hadn't been first planned this way

The bungalow is on the way up to make room for a new story below



You don't have to be a Douglas Fairbanks to escape from a burning building with convenient ornaments for steps

Built to Enable the Heroine to Escape When It's Burning

IN the foregoing illustration both the house and the frightened lady clutching Fireman Charles Chaplin are products of art—one being a plaster front and the other being made of straw, and dressed to look "very much of a lady."

The photograph illustrates a simple ladder device that is used frequently in taking moving pictures. The various decorations and projections, as here shown, form a very serviceable and convenient set of rungs, by which one can clamber up the face of the building at will. The screen throws light on the scene, while the excitement of the men on the ground imparts a touch of realism.

Training the Anti-Aircraft Gunner

Why not use free balloons shaped like airplanes?

By Carl Dienstbach

IN the good old days when Wild West shows instead of motion pictures thrilled the youngster who yearned to lead the life of a scout cunning enough to outwit the wiliest Apache, Buffalo Bill would gallop around the tanbark ring, preceded by a rider who tossed glass balls into the air. Raising his trusty rifle to his shoulder, Buffalo Bill would fire at the balls tossed up in front of him, if not exactly with unerring aim, at least with an accuracy sufficiently startling to make every small boy on the bleachers put his two fingers to his mouth and whistle in joyous admiration.

Firing at an airplane with an anti-aircraft gun is about as hard as shooting at glass balls from horseback. Therefore, it has been suggested that the anti-aircraft gunner be trained by making him fire at small target-balloons shaped like airplanes.

No gunner needs so much practice as he who aims at elusive bomb-droppers. If the formerly inefficient anti-aircraft guns have become formidable, it is due entirely to experience gained in three years of warfare. What may not be expected of systematic preliminary practice?

Some Objections to Balloons

It may be objected to the target-balloon scheme that the drift of the free balloons is much slower than the flight of a modern airplane. To this it may be replied that the smallness of the targets makes up for their slowness. Moreover, if they are sent up on a stormy day their drift may become as fast as sixty or seventy miles an hour.

To make target practice of this kind as realistic as possible, it would, of course, be advisable to shape the balloons somewhat like airplanes. This plan is now followed in training air gunners to fire at balloon targets towed from airplanes.

It is possible that even tissue paper bags floated by an alcohol flame might answer; but they could hardly attain great altitudes.

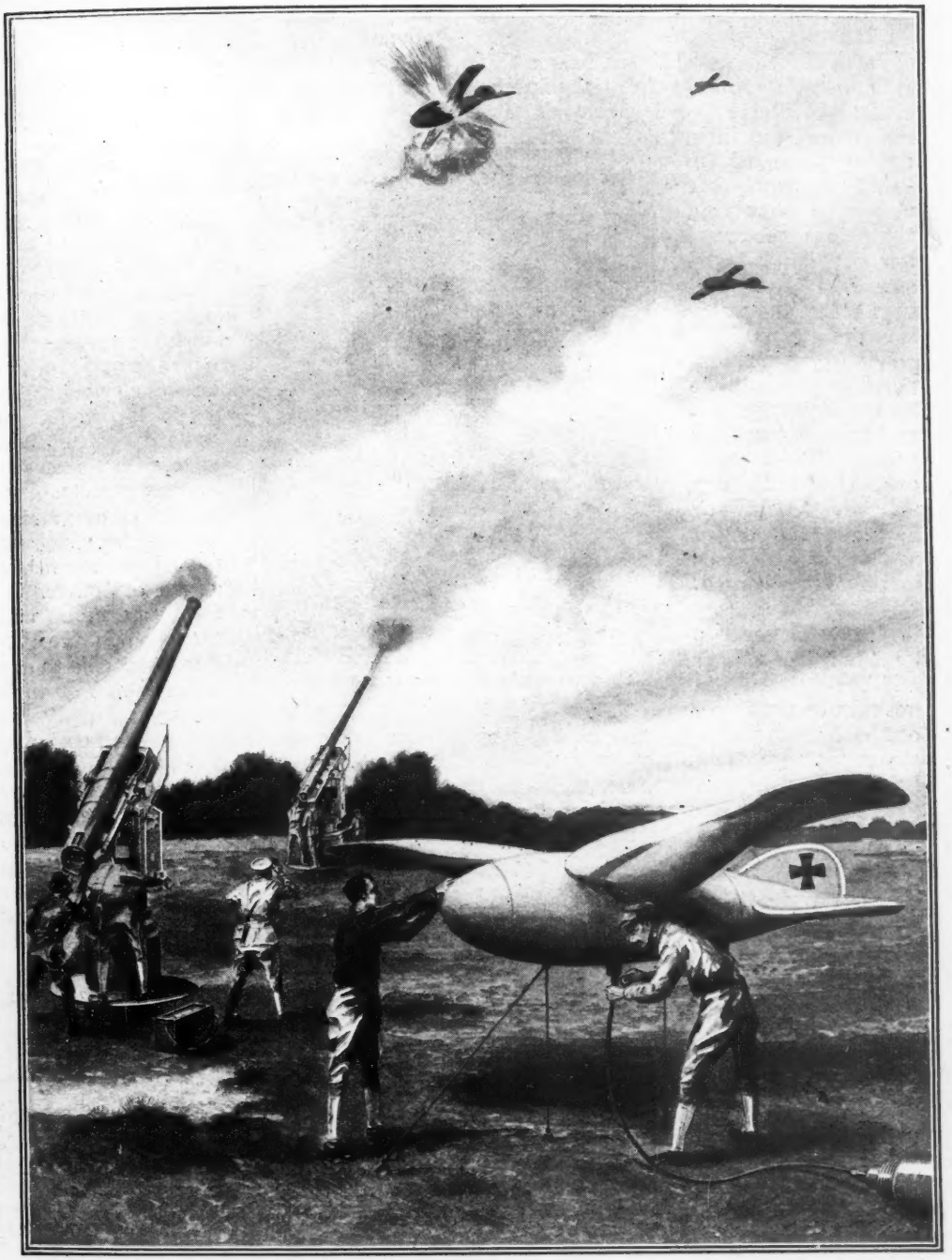
The only real objection to the plan is the fact that in order to attain a great altitude it would be difficult to release the balloons so that they would actually drift into the range of the guns. After all, time enough must be given to them to reach a high altitude. There is also the difficulty that the real problem of aerial gunnery is that of determining how much time must be allowed for the speed of the airplane so that the projectile will actually hit it. It would never do to aim at the airplane where it is at the moment; it must be aimed at where it will be five or seven seconds hence. If it were possible to attain a great height with free balloons while they are still within range, even the smallness of the target would not sufficiently make up for its relatively slow motion. The gunner does not get true practice in making the proper time allowance.

Why Not Use Dirigibles?

A plan that offers much better opportunity for practice to the anti-aircraft gunners would be to send up a swift and powerful dirigible balloon and let it tow a whole string of aerial targets, either balloons or kites, at the desired distance and height. Even when handicapped by the resistance to the air of the towed balloons or kites a dirigible could attain great speed, particularly when going with the wind. In that case, it could reach airplane velocity.

The weight of the towing cable would not prevent a powerful dirigible from rising to a great height and the cable could be made long enough to insure the safety of the dirigible from stray shots. The conditions, being under almost perfect control, could be sufficiently varied at will to give to the gunners ample opportunity to obtain a thorough training in estimating distances, angles and the necessary time allowances in placing shots at moving targets. Kites, of course, would be the most economical targets.

Trap-Shooting with Anti-Aircraft Guns



Trap-shooting is an excellent training for bird-hunters. Shooting with an anti-aircraft gun at an airplane is somewhat like shooting with a shotgun at flying ducks or snipe—only more difficult. Anti-aircraft gunners need previous training even more than bird-hunters. Why not let them go through a course of modified trap-shooting, with balloons shaped like airplanes as targets, instead of clay pigeons? Another plan would be to let them shoot at balloons or kites, towed with great speed by powerful dirigibles

A Whistle Sounds When the Cooking Water Runs Low

DON'T be startled if you hear a shrill whistle sounding from the kitchen where the dinner is being cooked. It is not a call for help nor an alarm of fire —only a signal that the water supply in the steam cooker is low. The whistle sounds fifteen minutes before the water is entirely gone.

The food is cooked by steam. A whistle blows when the water is too low

The food is prepared as it would be for the ordinary stove and placed in the cooker. The food cannot scorch, dry up, over-cook, or burn. It is cooked in the same utensils in which it is served. Vegetables and custard may be set side by side in the cooker and the custard will not take on the flavor of the onions. The cooking is done by steam pressure, the nutriment and flavor being cooked into the food.

The cooker can also be used for canning foods.

Make Waste Hot Air Work and Conserve Both Fuel and Food

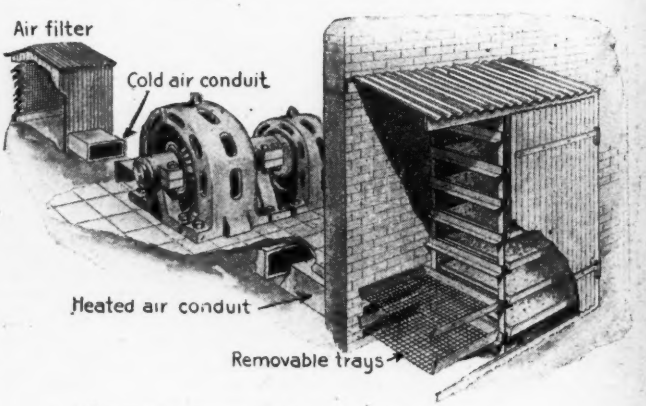
THE heat generated by the running of the alternators has always been a source of annoyance to the station engineers of light or power plants. The degree of heat produced depends upon the amount of work done by the alternator and is usually more than sufficient to soften insulations and to cause other troubles.

It is necessary to cool the alternator by forcing a stream of cool air through the casing. The cool air is first drawn through a filter, then conducted to the alternator. By circulating around the alternator the air becomes heated, and it is then allowed to escape through a suitable shaft or opening.

Mr. Fietz, the engineer of an electricity station in Duisburg, Germany, realizing the great waste it means to allow this heat to escape unutilized, conceived of an exceedingly simple plan of avoiding this waste of heat.

His plan was to conduct the heated air to the bottom of a drying press, erected over the outlet of the hot-air shaft and utilize it to dry a large quantity of fruits and vegetables arranged in layers upon drying trays of galvanized iron wire and placed on shelves one above the other. In this way Fietz and the men in the station were able to dry a large part of their winter supply of fruits and vegetables at a small cost and without burning any additional fuel.

It was found that in each of the trays about twenty-two pounds of vegetables could be dried at one time and that the drying required from four to six hours. The hot air, after circulating through the stacks of trays containing the fruit and vegetables to be dried, was allowed to escape to the inclosure outside.



Alternators must be cooled with a stream of air. Why not utilize the air so heated?

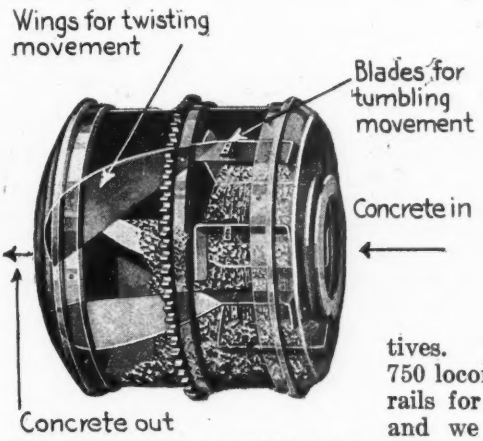
Mixing a Batch of Concrete in Twenty Seconds

A TWISTING or turning movement as well as one of tumbling is required to mix concrete thoroughly in a cylindrical drum. At first slanting blades or fins were mounted inside of the drum, but these did not mix the concrete properly into a homogeneous mass unless the drum was revolved long.

Since time is an important element in mixing concrete and one directly affecting the cost, the new principle of mixing shown in the accompanying illustration was devised.

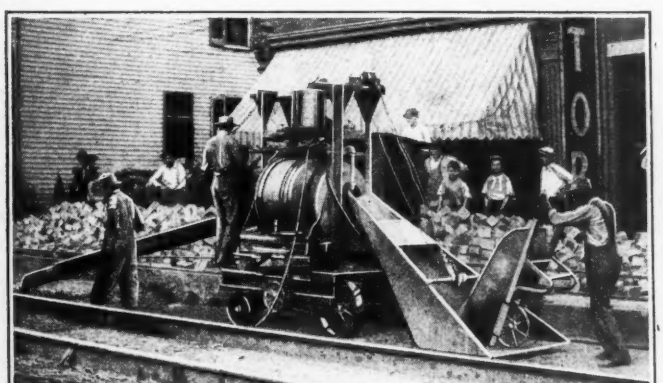
A batch of slush concrete can now be mixed in four revolutions of the drum; and a thicker mixture in from twenty to thirty seconds.

These results are obtained by using two independent sets of blades, a set of six buckets parallel with the length of the drum, and curved wings running from each alternate bucket to the outlet end of the drum. The buckets give the necessary tumbling movement and the wings furnish the twisting or kneading action.



This shows how the twisting and tumbling movements are combined

The use of this mixer will result in a big saving of time, which means a big saving of money.



A mechanical concrete mixer which produces the desired consistency in the course of twenty to thirty seconds

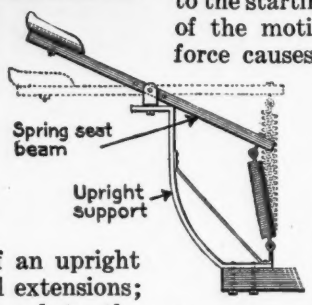
For an Army of Four Million a Ship Must Sail Every Hour

"OUR ship program is a very serious one," says Major W. A. Garrett in an article published by the Journal of the Engineers' Club of Philadelphia; "in fact, the situation during the war. To feed an army of a half million men and the horses for a half million men and the guns for a half million men requires three ships a day—one every eight hours. For a million men, a ship every four hours. For four million men—and we will have four million fighters in France before we are through—one ship every hour from the United States to France, and every ship must run the blockade to get there. A trail of smoke between the United States and France. First we must get our army over, and this will require ships, and then we must send supplies to feed them. Then we must have more ships to take our locomotives. The British have 750 locomotives on French rails for a fifty-mile haul, and we have a 400-mile haul.

Then we must have ships to handle our freight cars (the British have 49,500 for a fifty-mile haul and we have a 400-mile haul). Then we must have ships for our rails, our machinery, and then we must have ships for the foodstuffs and ammunition for our allies."

The Government realized the gravity of the problem at the outset. The taking over of shipyards, the establishment of new ones, and the appointment of Charles Schwab to take charge of ship production are successfully solving the problem.

The helical spring absorbs shocks encountered in the rough work of the field and saves bumping



A Novel Spring Seat for Farmers

LEWIS E. BAKER, of Hudson, Illinois, has patented a novel spring seat. The device consists of an upright support provided with lateral extensions; the lower extension is fastened to the vehicle, the upper one carries the seat on a cross-bar mounted on a pivot. The free end is connected with a coiled spring fastened to the bottom foundation. When the driver seats himself the spring is stretched just enough to place the beam in even balance, yet retaining enough "play" to overcome the "thank - you - marms."

Using Steel Balls in a Flywheel

THE effectiveness of a flywheel in maintaining the rotary movement of an engine at a uniform speed under variations of the load or driving power depends upon the size and weight of the wheel. The heavier the wheel the more effective it will be in maintaining a uniform speed.

But, the heavier the flywheel, the greater the resistance which its inertia offers to the starting of the engine. To overcome this drawback Ralph Humphries, a Canadian, has invented the flywheel shown in the accompanying illustration.

This flywheel, which must necessarily rotate in a horizontal plane, consists of a sheet metal cup with a central depression in the part nearest to the shaft. The weight element of the wheel consists of heavy metal balls or some heavy liquid, such as mercury. When the wheel is at rest the balls or the liquid occupy the lowest part of the cuplike casing. They offer but little resistance to the starting of the engine. As the speed of the motion increases, the centrifugal force causes the balls or liquid to leave the part near the shaft and to move toward the periphery of the wheel. The weight thus equally distributed along the periphery makes the wheel an effective flywheel. As the speed diminishes and eventually ceases, the balls roll, or the liquid runs back to the cup-shaped part around the shaft.

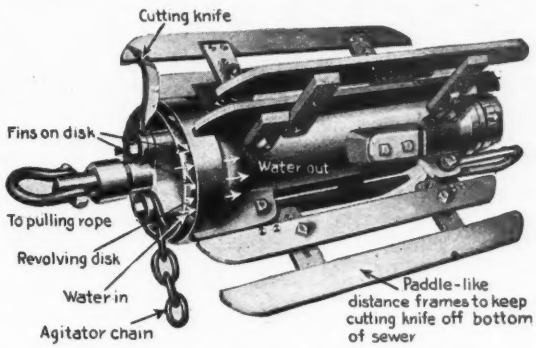
As the speed of the flywheel increases, the balls are whirled up toward the periphery. Thus, the flywheel accommodates itself to the engine load

The Microphone Has Given Place to Other Devices

WHEN the Germans began to mount their motors on sound-absorbing bases, the original microphones employed by the Allies for the detection of the submarine, which depended upon the hum of the engines and motors, were no longer effective. The devices substituted have reached a high state of excellence, not only detecting the presence of the submersible when it is in motion, but also its exact location.

The Sewer-Worm Cuts Its Way Through Clogged Pipes

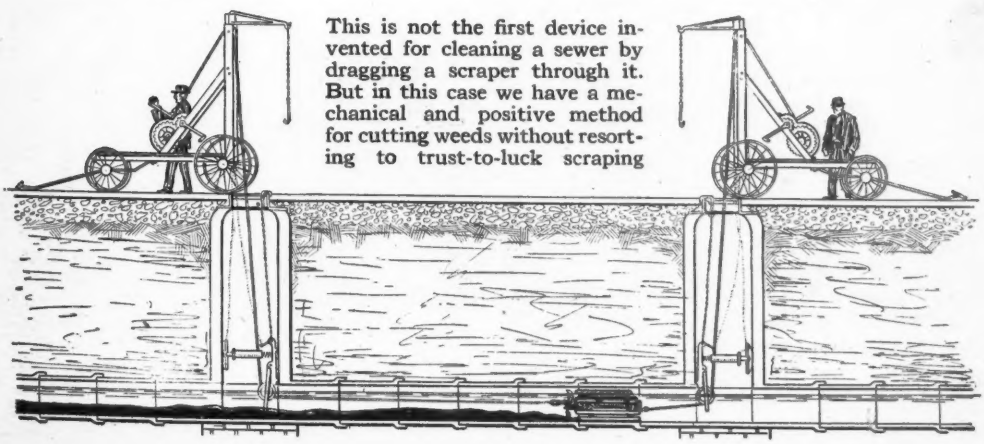
AN entirely new type of a sewer-cleaning device has recently been placed on the market. It consists of a bell-mouthed tube with a rotary disk at the front end. As the tube is drawn through the sewer by means of a rope attached to the hook at the front end of the device, the force of the water, acting upon the slanting fins of the disk, causes it to revolve rapidly within the bell-shaped end of the tube. At opposite points of the disk a curved cutting knife and a short end of heavy chain are attached. As the disk rotates under the pressure of the water against the fins, the chain agitates the clogging deposits on the bottom of the sewer in order that the knife may cut through it easily. Four paddle-like fins attached to the outside of the tube keep the cutting edge of the disk clear of the sewer bricks. The hook, to which the pulling rope or cable is attached, is swiveled and hence does not rotate with the disk. This precludes all danger that the hauling rope will be twisted. The accompanying illustration shows how the device is operated.



As the disk rotates under the pressure of the water against the fins, the chain agitates the clogging deposits for the knife to cut through

Send Your War Inventions to Inventions Section, General Staff

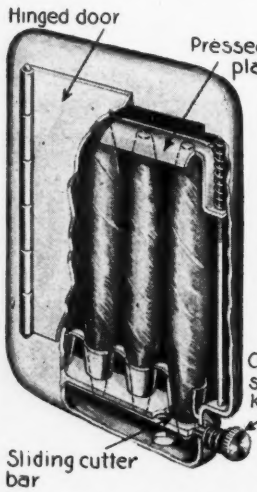
AN Inventions Section has been created as an agency within the General Staff to investigate promptly and thoroughly all inventions submitted to it. Any person desiring to submit an invention for consideration, test, sale, or development, should do so by letter, giving in order the following information: Name and object of the invention; any claim for superiority or novelty; any results obtained by actual experiment; whether the invention is patented; whether remuneration is expected; whether the invention has been before any other agency; whether the writer is owner or agent; the number of enclosures with the letter. A written description and sketches or drawings of sufficient detail to afford a full understanding of the cases should also be submitted. Should the invention be an explosive or other chemical combination, the ingredients and processes of mixture should be stated. All expenses must be borne by the writer. Communications should be addressed: Inventions Section, General Staff, Army War College, Washington, D. C.



This is not the first device invented for cleaning a sewer by dragging a scraper through it. But in this case we have a mechanical and positive method for cutting weeds without resorting to trust-to-luck scraping

Just One Twist—and All the Cigars in Your Case Are Beheaded

FOR the convenience of cigar smokers, Charles E. Johnson, of New York, has invented a combined pocket cigar-case and cutter. The case, which holds four cigars of average size, has a hinged door and at the lower end four conical, thimble-like cups, intended to accommodate the points of the cigars. These cups are open at the lower end, so that the tips of the cigars protrude into the space below the receptacle for the cigars. A sliding cutter is arranged in that space so that it will cut off the points of all cigars in the case at the same time, when a knurled knob is turned or pushed in. The cut-off ends drop through openings provided in the bottom part of the compartment containing the cutter.



Turn the knob and cut all cigar tips at one clip

The inventor seems to assume that the cigars placed in the case are of the same size; for, to hold them in place and to press them against the cutter, he has provided a curved plate sliding along guide rods and pressed against the lighting ends of the cigars by means of springs. The plate has to be raised before the cigars can be placed into their respective cups. It is not quite clear why the inventor has provided for cutting off the ends of all cigars in the case at the same time instead of arranging it so that each cigar can be guillotined just before it is lighted.

To the smoker who has many cigars to give away this cutter is likely to be very useful.

A Sanitary Method of Cleaning Floors with a Mop

IF you chanced to be in the American Museum of Natural History some time when the floors were being washed, you would see a squad of men, each equipped with a mop which cleaned the white floor without leaving a single dirty streak. This phenomenon is explained by the presence of a square steel tank mounted on a portable truck, the invention of Harry F. Beers, Chief of Construction of the Museum. It is divided into two compartments. One contains the cleaning fluid and the other the clean rinsing water. Each compartment is provided with a drainage cock. A mop-wringer is mounted over the compartment containing the rinsing water. The mop is inserted without the necessity of handling it; the lever is reversed; by turning the crank the mop is drawn upwards and squeezed thoroughly dry. When the job is done, both compartments of the tank are drained by opening the cocks.

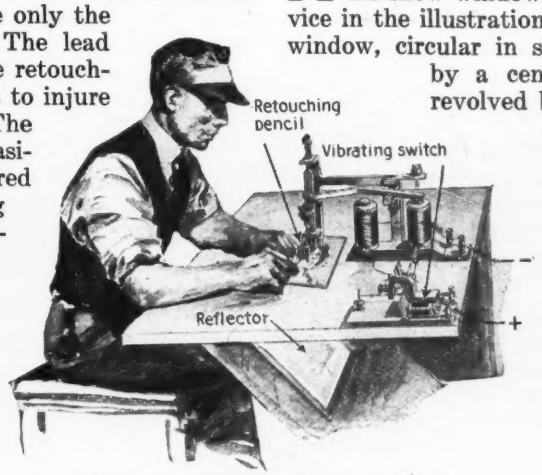
Cleaning a floor in the American Museum of Natural History, with a sanitary device consisting of a steel tank divided into two compartments and a mop-wringer which squeezes water out of the mops

In Retouching Photographs, Move the Plate

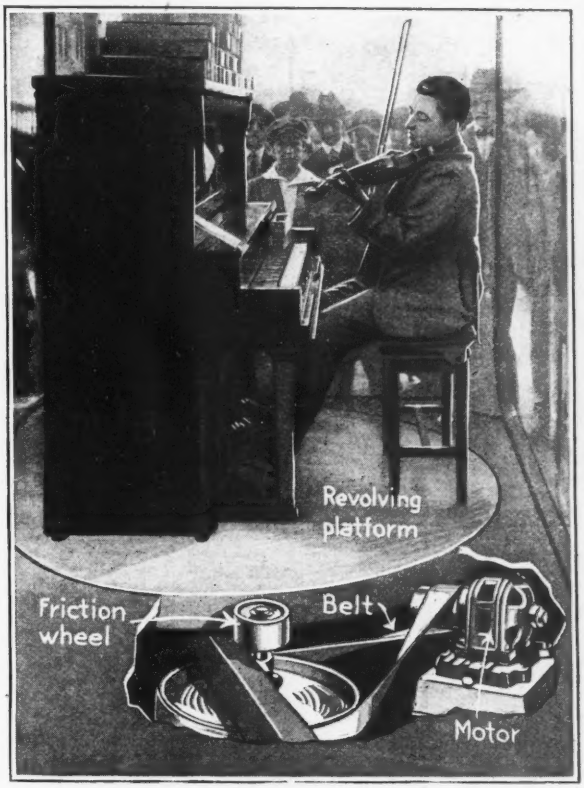
TO lighten the most tedious and wearisome task of the photographer, that of retouching negatives, as well as to make the work quicker and more accurate, is the object of an electrical negative retoucher invented by R. L. Woods. This device reverses the ordinary method of retouching by keeping the retouching pencil stationary and moving the negative to obtain the desired effects.

The negative is laid on a flat bed provided with an opening. Through the opening and through the negative shines the light reflected from an inclined mirror below. The mechanical portion of the retoucher, mounted above the bed, consists essentially of a retouching pencil which is worked up and down by a cross arm actuated by two electro - magnets. These magnets are controlled by a vibrating switch set in the circuit so that they are alternately energized, thus raising and lowering the retouching pencil, causing it to mark the negative on the down stroke. The length of the stroke and hence the size of the mark made upon the negative may be regulated by a set screw acting against the cross arm and allowing it to move only the desired distance. The lead is set loosely in the retouching pencil so as not to injure the negative. The operator proceeds easily to get the desired effects of retouching by moving the negative under the pencil.

Mr. Wood has hit on a most novel and unique method of photograph-retouching, which will appeal to photographers everywhere.



Did you ever try to draw a picture by moving the paper against the pencil?



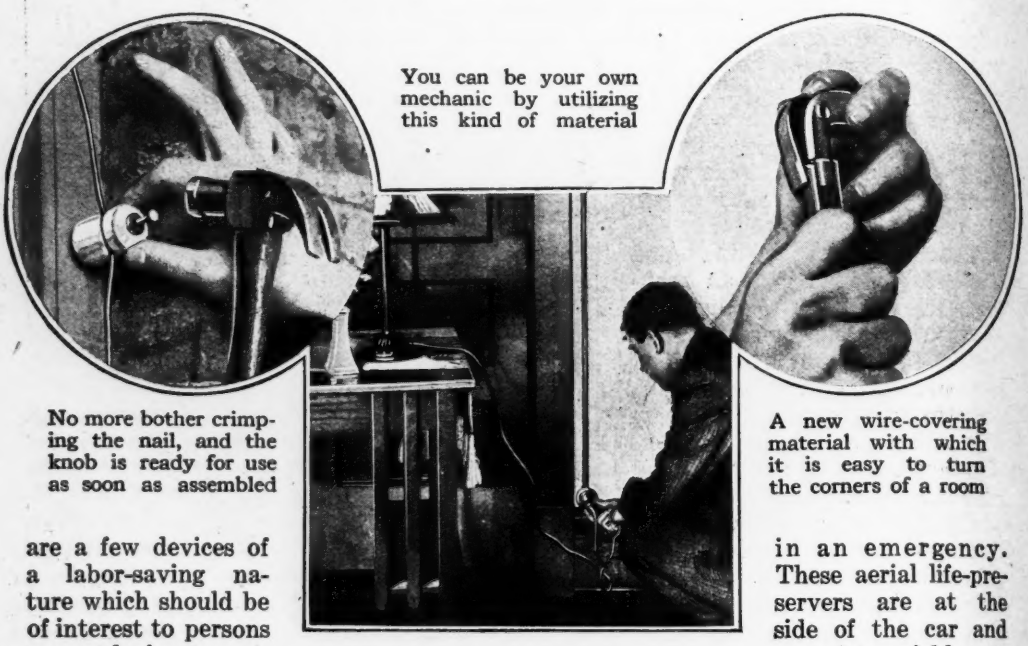
To make people look at his store window, one shopkeeper installed a revolving platform operated by the device shown above and attracts much notice

Plenty of Action Here; the Whole Window Display Turns

A CALIFORNIA shopkeeper makes his show window revolve by the device in the illustration. The floor of the window, circular in shape, is supported by a central shaft, and is revolved by a friction-pulley rubbing against the under side of the platform's rim. An electric motor beneath the platform supplies necessary power by means of a belt and another pulley on the friction-pulley shaft. The merchant varies his display from week to week.

Devices That Make Temporary Wiring Easy

THE present war conditions, especially the shortage of labor and materials, have opened a field for labor-saving inventions in every branch of work. Here



You can be your own mechanic by utilizing this kind of material

No more bother crimping the nail, and the knob is ready for use as soon as assembled

A new wire-covering material with which it is easy to turn the corners of a room

are a few devices of a labor-saving nature which should be of interest to persons engaged in temporary electrical wiring. A simple and helpful device is an assembled porcelain knob held in place by a nail with a leather cushioned head. Simply driving the nail into the support fastens it securely. A steel washer serves to hold the parts of the knob together until the nail is driven in. The leather cushion on the head of the nail is intended to prevent the cracking of the porcelain knob when it is nailed down.

For securely covering the wires in accordance with the requirements of the underwriters and without defacing the walls of the room or hall a new covering material has been placed in the market. It is unobtrusive in appearance and easily nailed down by even an inexperienced person. One of the pictures shows the device used for covering the wires where a corner has to be turned. It fits the end of the covering strip and is fastened by a nail driven through a hole provided for that purpose. The strips may be purchased ready for use.

"Shooting the Parachutes" Makes You Feel Like a Wriggling Worm

THE kite balloons which do sentinel duty over the waters surrounding the British Isles are provided with parachutes, which are used by the observers in an emergency. These aerial life-preservers are at the side of the car and may be quickly attached to the braces worn by the men.

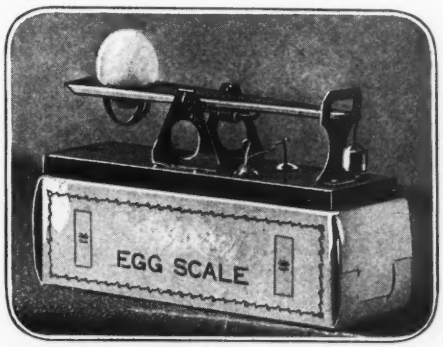
No time should be lost in putting the parachute to work after a balloon collapses or bursts into flame, for the bigger the drop the safer it is for the parachuter.

An old kite balloon observer thus describes the sensation of dropping through space at the lower end of a parachute: "You see, the parachute doesn't open until you've fallen about three hundred feet. After that three hundred feet you come down at the rate of twelve miles an hour, or a bit less. The last part of the journey is the worst. You feel like a worm wriggling at the end of a fishing line. As for the first drop, that takes place so swiftly that you never think of it until afterwards. You shut your eyes, and you feel fearfully cold for an instant, and you can't get your breath, and then you find yourself floating gently toward the water, and you have a horrible longing to clutch on to something with your hands."

Despite all, there must always be a fear lest the parachute fails to open as expected.

Count Your Chickens Before They Are Hatched by Weighing the Eggs

PRACTICAL tests and experiments by agricultural colleges and poultry raisers have established the fact that it is not profitable for a poultryman to use an egg weighing less than 23 ounces a dozen for hatching, as it was found practically impossible to hatch a strong, sturdy chicken from a lightweight egg. Realizing the importance of the weight of eggs the large poultry breeders in California and elsewhere abandoned the formerly used method of grading by size and employed various crude methods for grading by weight. Recently a practical poultryman, O. C. White, in Gardena, Calif., devised a simple scale which will indicate the weight of eggs weighing between eighteen and twenty-nine ounces a dozen.



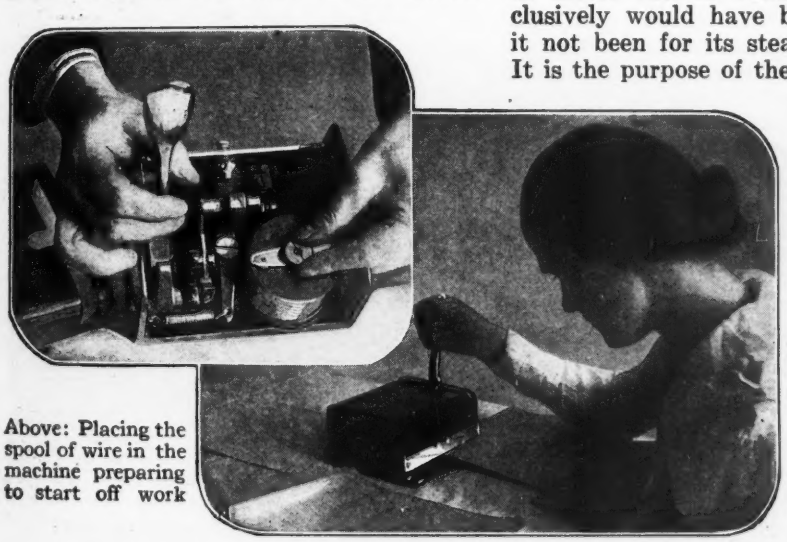
Want to raise sturdy chicks? Weigh your eggs and discard the light-weights

This Stapling Machine Uses a Spool of Wire

A DEPARTURE from the type of machine used heretofore to bind papers together is shown in a new device which, instead of relying upon ready made fasteners, uses a roll of wire and makes its own binders. The economy of operation which results is striking. A single spool of wire serves for some fifteen thousand staples before it is used up, eliminating the loss of time due to frequent reloading, which other machines require. Moreover, the cost of the material is considerably lessened, amounting to less than ten cents for every thousand staples.

The machine binds from two to forty sheets of paper. The new kind of staple, when clinched, is flat and therefore takes up little space in the files. The machine is small, being six inches square on top and bottom and stands four inches high.

Index arrows on the front plate enable the operator to locate the staples accurately with respect to margins and see where the staples will cut the sheet.



Above: Placing the spool of wire in the machine preparing to start off work

The girl can see at a glance just where the binding staples will cut the sheet

Alcohol and Benzole as a National Motor Fuel in France

ALCOHOL, mixed with an equal quantity of benzole, has been used as motor fuel in France. Its use exclusively would have been general had it not been for its steady rise in price. It is the purpose of the French Government to secure a monopoly of alcohol and to encourage its use in industry while laying a heavy tax on its human consumption. It will be carried out when the war ends.

He is wearing all the wool that's in your "all-wool" suit

"All Wool and a Yard Wide"

What "all wool" really means
and why shoddy is a necessity

By Frank Parker Stockbridge

"WHAT is shoddy?"

Ask that question of the next ten men you meet, and nine of them will reply, in substance if not in terms: "Stuff they use to make soldiers' uniforms of." Some of them will proceed to a denunciation of the President, the Secretary of War, the Quartermaster General and the "Woolen Trust." The tenth man, however, will know something about the wool business, and if he has time and you are sufficiently interested to listen, he will tell you a good many things that tend to make the loud outcries of those who are declaiming against "shoddy" uniforms sound as blatant as the voices of the sheep whose product they think they are defending.

"Shoddy," this tenth man will tell you, "is what you get when you buy 'all-wool' clothes—that is, unless you pay $100 or more for a suit or overcoat. A good, heavy overcoat, now, made of pure, new wool, would be worth somewhere around $200, I should say, perhaps a little cheaper, if you could get it at all—which you can't."

After you have recovered your breath, the man who knows all about the woolen business will tell you more in a minute about shoddy and wool than you could find in the libraries in a week. For instance:

There isn't wool enough in the world—new wool—to clothe the human race properly. If it wasn't for shoddy we would all be wearing cotton principally, even in the dead of winter. We wear a good deal of cotton now, for a large percentage of the popular hard-finished worsted fabrics of which men's clothing is made contains cotton as well as wool.

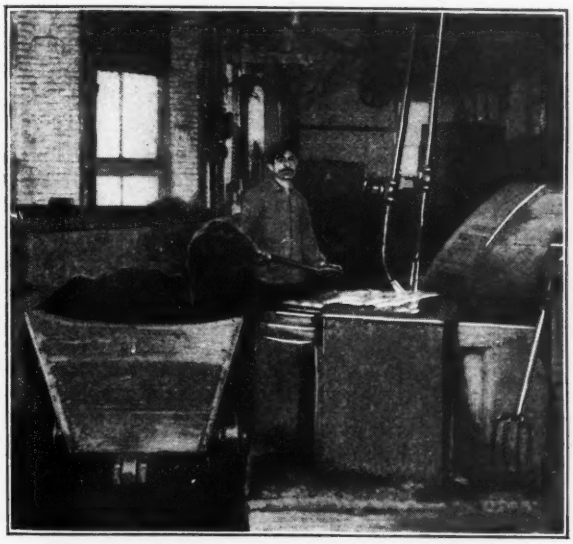
Shoddy Is Now "Remanufactured Wool"

When your tailor tells you, however, that a piece of goods is all wool, it may contain as high as sixty per cent shoddy, and he will still have told you the truth. For shoddy is wool, pure wool and nothing but wool, but it is wool that has previously been fabricated, perhaps worn, and reclaimed. "Remanufactured wool" is the term the wool trade is now trying to substitute for shoddy, since the latter word has come to have a significance that implies something not only cheap but fraudulent. Originally it was an English factory term, applied to the waste thrown off or "shed" in the process of wool manufacture. Now it means wool recovered either from old clothing or from the trimmings and remnants from the manufacture of clothing and made over like new.

Dye vat and hydro extractor. After material is dyed, rinsed and dried, it is ready to be turned into the picking machines

When Uncle Sam dresses his soldiers and sailors in shoddy, the woolen man will tell you, he is merely doing what every other nation engaged in the war is doing. For although there is on hand and in sight in the United States to-day twice as much wool—some 1,260,000,000 pounds—as we have ever used in any one year, there isn't enough to supply the cloth we are making here for uniforms for our European Allies, the goods needed for our own forces and the demands of the civil population, unless there is added to the fabrics made for all of these purposes a good deal of shoddy as well as a lot of cotton. The Committee on Wool Conservation of the National Association of Wool Manufacturers in a statement issued last fall said:

"There has always been a considerable quantity of cotton yarn, raw cotton and reworked wool used in the manufacture of woolen and worsted fabrics and because of the rapid advance in the cost of wool during the last year and a half the percentage of these substitutes has very largely increased and will automatically continue to increase." The association adopted resolutions to discourage the use of all-wool materials by civilians as far as possible and agreed to place on the market as large a proportion of mixed goods as possible.

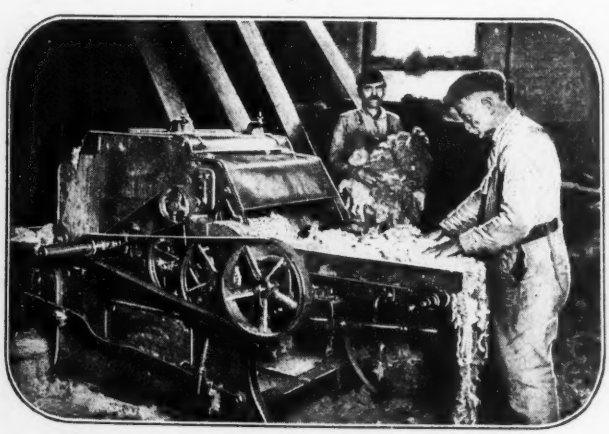


Washing machine in operation. It is in this way that the stock is washed and rendered sanitary

The Wool Used for Soldiers and Sailors

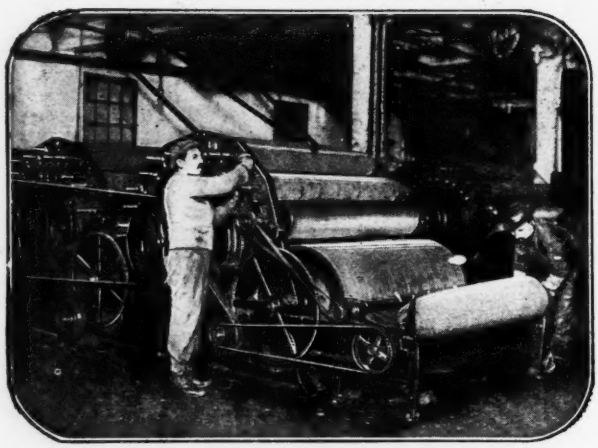
Cloths used for uniforms by the American Army run from sixteenounces to twenty ounces to the yard of goods. The sixteen-ounce material, which is lighter weight than is used by any of our Allies, is all new wool. Specifications recently issued for the manufacture of twenty-ounce material for the Government call for fifty per cent wool and fifty per cent shoddy, and the proportion is permitted to run up as high as sixty per cent of shoddy. Overcoat materials, weighing thirty-six ounces and more to the yard may be even higher in the shoddy percentage, as are Army blankets.

"At that," your friend in the wool trade will tell you, "our soldiers are better clothed than you are, for you are wearing worsteds, and while worsteds don't contain shoddy, they do contain cotton. Out of 3,000 worsted looms in the United States, there were in September, 1915, only 950, or 31.7 per cent, running on cotton warp goods. In September, 1917, 2,395 of these looms, or 77.2 per cent were making cotton warp fabrics."



This picture shows the picking machine in operation. It tears and converts the stock into threads again

You ask the difference between woolens and worsteds, and learn that it is in the spinning of the threads from which the fabrics are woven. The characteristic of wool that makes it different from all other fibers is that it tends to "felt" or mat together, the fabrics being covered with surface spines or irregularities that interlock with those of adjoining fibers to form a tight mass without weaving. Woolen goods are made of carded wool—that is, wool that has been merely smoothed out, as it were, and drawn down into threads with the fibers tangled, twisted and running "every-which-way." Fabrics woven from these threads require a vast amount of "finishing," the purpose of which is to mat or "felt" the fibers of the finished cloth together, producing smooth surfaces and a "body" that depends as much upon the felting quality of the wool for its substance as it does on the weaving. Worsteds, on the other hand, are woven from threads formed just as cotton threads are—the wool combed out until the fibers lie parallel, when they are twisted into hard threads. Worsted cloths require very little finishing after weaving. It is smooth to the touch.



The carding machine breaks up the stock into its fibrous state and prepares it for the spinner

This is the way in which the stock comes out of the carding machine—broken up into fine fibers

Have You Heard of "Mungo" or of "Extract?"

"New wool fibers," your friend tells you, "run from five or six inches to above fifteen inches in length and from 1/3,000 of an inch to 1/275 of an inch in diameter, depending upon the breed of the sheep, its age when shorn, the country where it was bred and the particular part of the sheep from which the wool came, as a single fleece will contain several grades. Shoddy naturally varies in quality as much as do the cloths made from these different grades of wool. Indeed, the term 'shoddy' is technically applied only to wool recovered from cloth made from the finest grades and longest fibers. Reworked wool from cloths of lower grade is termed 'mungo' and that from cloth containing cotton as well as wool is called 'extract,' because the cotton has to be extracted from the wool by dissolving it away in sulphuric acid. And since the fiber of any of these grades of shoddy is short, compared with new wool, a considerable percentage of new wool must be mixed with it to make it usable. For the same reason, it cannot be spun into the sort of threads required for worsteds, but must be used in fabrics

the finish of which depends upon felting."

How heavy the demand of an army for woolen clothes is may be estimated by the fact that the average life of a uniform in the front line trenches of the British Army is only about six weeks. Early in the war, discarded uniforms were burned or destroyed. Now they are taken back to England where they are sorted, cleaned and repaired, if savable, and if not, sold for reworking as shoddy. About ninety truckloads of uniforms a day are received at the plant, which is saving the British Government about $5,000,000 a year. Worn-out uniform trousers bring $420 a ton; jackets, which originally contained a larger proportion of shoddy, $320 a ton. British uniforms are now being made of a cloth having an all-wool worsted warp and a wool filling which contains a high percentage of re-worked wool, or shoddy.

Millions of discarded uniforms are now being sent back to England to be remanufactured into shoddy cloth

The foremost American wool expert recently estimated that, to equip the two million men already provided for in our Army and Navy with their original outfits of uniforms, overcoats and blankets, it would require two hundred and forty million pounds of wool, or nearly the entire production of the United States for the year. If these require replacing on an average only twice a year, it is obvious that some of us will have to wear more shoddy—and more cotton—than we have been accustomed to.

In Germany and France and, to some extent in Great Britain, the shortage of wool was felt early in the war and the respective governments made appeals to their peoples to contribute every scrap of cast-off woolen material which could be used to "stretch" the supply of new wool.

New Rails from Old—How Railroads Save Money

STEEL is scarce and rail-rolling plants must charge more for their product than ever before. That is why George Langford, of Milwaukee, has patented a process for making new steel rails out of worn, old ones.

Several railroads are using his process; for they find they can reroll a 100-lb. 33-ft. rail into a 90-lb. section 34 feet in length or to a 92-lb. section 33 feet long. If the worn rails were cropped for relaying, their length would be only 30 feet. The new rerolling process increases the length as well as reshapes the heads.

The method of making old rails into new calls for heating the worn rails and passing them through reshaping rolls. In order to avoid changes in the character of the steel the work must be done at a moderate temperature. This means that the metal which must be forced to fill the section in the rolls while at a low temperature, is subjected to a severe draft that may cause internal difficulties and make the rails unreliable.

No special preparation of the rails for rerolling is necessary except running them through a grinding machine which removes the fins and barbs which have resulted from the pounding of the wheels.

This trouble has been overcome by bringing only the gage side of the rail head to standard section in the rerolling process, while the other, or outer side, is permitted to be of smaller size. This compensates for the loss of metal by wear.

Some railroads that have adopted the Langford process find the old 85-lb. rails roll into new 75-lb. rails, the 90-lb. ones into 80-lb. and the 100-lb. into 90-lb. rails.

Behold the University-Bred Horse Dentist

Doctoring the teeth of domesticated animals is a real business necessity

By J. G. Dolan, D. V. S., D. D. S.

Instructor in Dentistry and Veterinary Physiology in the New York State Veterinary College of New York University

THANKS to the fact that their food is raw and unrefined and contains all the mineral matter so necessary for the growth and repair of the tissues of the teeth, domesticated animals are almost immune from natural decay as well as diseases of the teeth. Yet, injuries, infection and unhygienic feeding often cause domesticated animals to experience acute tooth-troubles and for business reasons as well as from humanitarian considerations it has been deemed good policy to make animal dentistry part of the curriculum of our veterinary schools and colleges.

Veterinary students at New York University studying the microscopic structure of the teeth of domestic animals to learn of their diseases

At the New York State Veterinary College, which is part of New York University, animal dentistry is taught to students by lectures and practical demonstrations. The studies include oral surgery, examination, treatment and extraction of the teeth and determination of the age of animals by the character and condition of their teeth. The determination of the age of domesticated animals is of considerable economic importance, as the age to a great extent determines the value of an animal. The properly trained veterinarian is able to render expert assistance to prospective buyers of stock and is often consulted for that purpose.

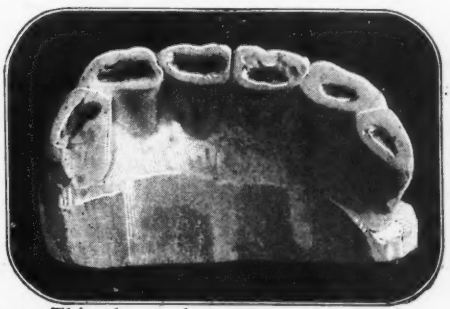
The technique of animal dentistry is much like that of human dentistry. An impression of the animal's teeth is made in a modeling mass composed of French chalk and beef suet or bees' wax. The compound is heated until soft and is pressed tightly against the teeth and gums. It hardens rapidly and may be removed after about sixty seconds. The mold thus obtained is then filled with plaster-of-paris. After the plaster has become hard, the mold is softened again and removed. The casts obtained by this method are used by the students in their studies and experiments. One of the illustrations shows the photograph of a finished cast of the lower incisor

He hates dentists as much as you do. The two students are trying to get an impression of his teeth in a modeling mass

arch of a horse, made of plaster.

The anatomy of the teeth is studied from microscopic slides and, when necessary, X-ray examinations of the diseased jaws and teeth of animals are made. The students are also instructed in oral surgery, which includes the treatment of fractures, the removal of benign or malignant tumors, the removal of foreign bodies and the treatment of wounds in the mouths of animals. The extraction of broken down carious or fractured teeth is performed under general anaesthesia, as are all surgical operations.

To assist the students in obtaining a thorough knowledge of the development of the teeth of animals and to enable them to judge from the teeth the age of horses, donkeys and cows, a series of casts is provided showing the development of the teeth of horses from one month to thirty years and of cattle to twelve or fifteen years. These casts are also used in court where expert testimony is conflicting.



This shows the appearance of the finished cast which may be used for determining the age of the horse

The mold is filled with plaster-of-paris and a cast is obtained, which can be used for demonstrations and the study of the teeth

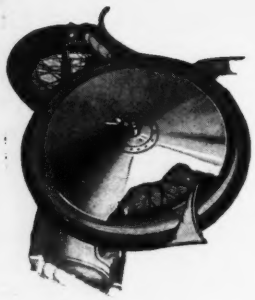
How Science Has Convicted Plants of Causing Hay Fever

WIND-POLLINATED plants are responsible for hay fever. Science is able to make this statement after considerable study. Moreover, it is also able to state just what plants are responsible. In the biological laboratory of the American Hay Fever Prevention Association, the oak, pine, willow trees, ragweeds, marsh elders and cockle-bur have been found to cause direct hay fever. In the grasses, the amaranthus and yellow dock stand accused of causing indirect hay fever.

The evidence against the trees, plants and grasses mentioned above was obtained through the use of a novel apparatus which determines whether a flower is wind-pollinated or not. The apparatus consists of a hollow cylinder with a fan attached at one end, by means of which a current is sent through the tube at from one to fifteen miles an hour. The flowers are held in place in the tube, the fan started, and the pollen is captured on glass slides coated with glycerin held in position at the outer end of the tube. The number of spores to a square inch of slide surface is determined, and, finally, the rate of pollen deposit of each flower.

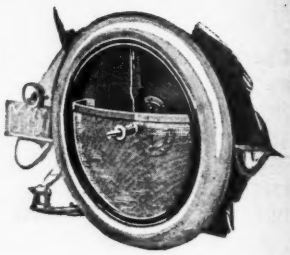
The common rag-weed showed the highest pollen deposit in a recent test. The giant rag-weed and the marsh elder follow it closely. These weeds, together with the grasses, spread their pollen in enormous quantities. In the case of corn the pollen is so large that it can not be distributed over a wide area. Ragweed pollen can travel half a mile, while corn pollen goes forty feet. Plants whose pollen is not found in the air and which are thus not directly responsible for hay fever are the goldenrods, daisies, dandelions and sunflowers.

How to avoid hay fever is the next question. Those who are subject to it may try breathing through fine cloth.

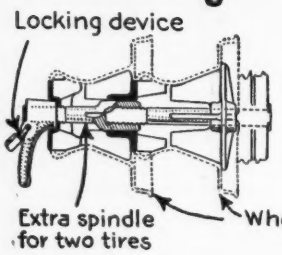


Above, a wheel in place, with rear disk broken away to show wheel and tire cover in position

In middle, above, a close-up view of clamping device of spindle nut, with padlock fastening



Above, wire cage mounted on forward disk to carry spare tools and other accessories to make repairs



At left is shown an auxiliary spindle strapped over the main spindle-bar to carry second tire or wheel

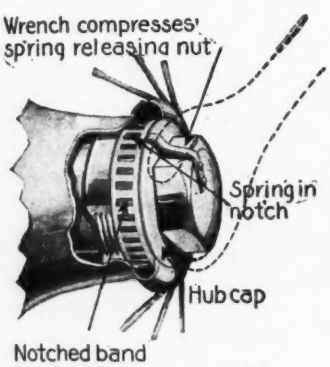
A Neat Thief-Proof Carrier for Automobile Tires

A SIMPLE and neat automobile tire-carrier is shown in the illustrations above. It consists of a pair of convex metal disks between which the tire or wheel is clamped by means of a nut on a supporting spindle attached to the rear of the car. Removal of the spindle nut instantly releases the outer disk and the wheel with its tire or the rim with the tire, according to whether a spare wheel with its tire complete is used or merely a spare tire on a rim.

The spindle nut holding the tire or wheel in place is provided with a clamping device which can be fastened with a padlock. The tire may also be enclosed in a cover between the two disks so that it is protected from rotting due to rain, snow or dirt. If desired, two complete wheels and tires or two tires alone may be carried on the spindle at the same time by the use of a second auxiliary spindle slipped over the main spindle bar. The forward of the two disks is provided on the inside with a semi-circular wire cage to hold tools, tire patches, etc.

Lock Your Hub-Cap and Your Wheel Won't Come Off

SERIOUS accidents may occur if a wheel of a rapidly moving automobile comes off. Wire wheels are easily removed, and it is important to prevent them from working loose while the car is in motion. A simple device for locking a wheel securely in place on its hub is shown in the accompanying picture. A band with a series of rectangular notches is fitted around the inside of the hub. To the nut of the hub-cap a spring is fastened, the free end of which is slipped between the hub-cap and the hub. When the wrench is forced on the nut it holds down the spring sufficiently to prevent its square head from engaging in one of the notches while the nut is fastened. When the nut is screwed down and the wrench is removed, the spring, no longer held down, presses against the notched band of the hub and its square head springs into one of the notches, locking the nut securely. The advantage of this device is that it requires no key or special tools to fasten or unfasten it. The ordinary wrench will operate it.



Forcing the wrench over the nut releases the hold of the locking spring

FOR PRACTICAL WORKERS

Using One Pane in a French Window for a Ventilator

ALTHOUGH they are steadily becoming more popular, it has always been found rather difficult to regulate the ventilation of a room having French windows because of the fact that any opening must necessarily extend from top to bottom, which causes drafts.

An excellent way of avoiding this difficulty is to remove the pane of glass from one of the upper corners. Take four strips of new tin about 1 in. wide and bend them double so that they will fit around the edges of the glass like passe-partout tape. Solder the corners, and then solder on two narrow butt hinges. Fasten a small projecting lug to the outer edge, paint to match the woodwork, and hinge in place. Run a light cord from the projecting lug through a small eyelet directly opposite in the sash, and then down to one or more small hooks. Tie a ring to the lower end, and make the length such that the glass will be swung into place and held there when the ring is on the lower hook. By means of a small spring run from the glass frame to the sash near the hinges, the ventilator may be made to swing open as soon as the cord is unhooked. Where the appearance is not important, a piece of wall board may be used instead of glass, proceeding in the same manner as above indicated.—JOHN D. ADAMS.

One pane of glass is used for the ventilator opening

How to Put a New Wick in a Mechanic's Torch

TORCHES are used by all classes of mechanics. The ordinary torch has a wick about ¾ in. in diameter, consisting of strands of candle wicking, and when a new wick is to be inserted it is often found to be a troublesome job. The easiest way of re-wicking a torch of this kind is to pass a strand of the candle wicking through the oil opening at the top, and then through the extending wick tube of the torch; then tie the end of this strand to the main strand so as to form a loop about 3 feet long. By pulling this loop through the torch a strand is added at every complete cycle. After repeating this until the wick tube of the torch is completely filled with wicking, it is cut off ½ in. from the top of the tube, the rest of the loop being inserted into the oil hole of the torch. Candle wicking may be purchased in rolls or balls from some hardware stores or plumbing supply houses or, possibly, ship-chandler stores. —W. H. THOMAS.

A Solution for Re-Inking Typewriter Ribbons

USE the following formula for black: 1 oz. of aniline black, 15 oz. of pure grain alcohol, 15 oz. of concentrated glycerine. Dissolve the aniline black in the alcohol, then add the glycerine. For blue ribbons use Prussian blue; for red ribbons use red lead in place of the aniline black.

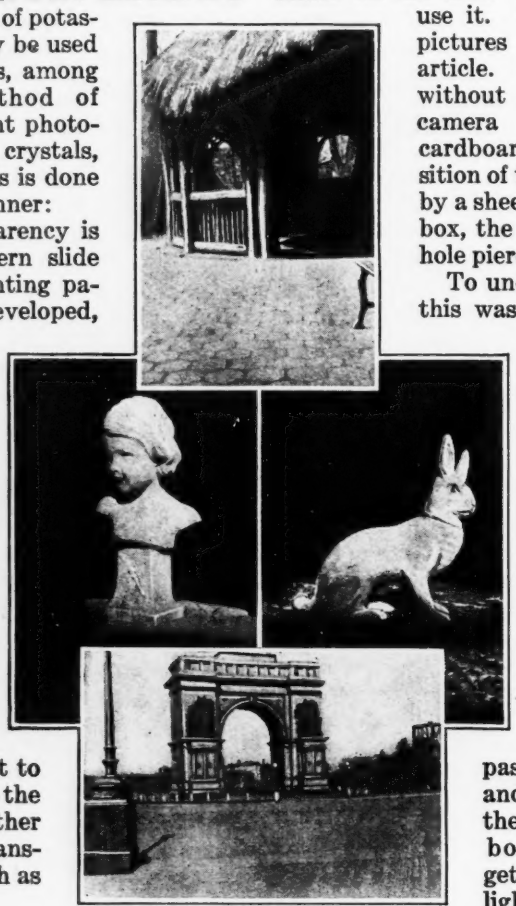
Removing Photographic Film for Mounting on Watch Crystals

IT is not generally known that the film may be easily removed from a negative plate by soaking it for a few minutes in a solution of carbonate of potassium. This fact may be used in a number of ways, among which is the method of mounting transparent photographs on watch crystals, chinaware, etc. This is done in the following manner:

A positive transparency is made, using a lantern slide plate instead of printing paper; this plate is developed, fixed and washed in the usual way and then soaked for about five minutes in,

Carbonate of potassium..... 6½ oz.
Water..... 6 oz.

After this is done it is wiped dry with a soft cloth and put by over night. In the morning it will be found that the film lies loose on the glass. It is then cut to size and pasted on to the watch crystal or other article with any transparent adhesive, such as Canada balsam.



Reproductions from films that are made with a pinhole camera lens

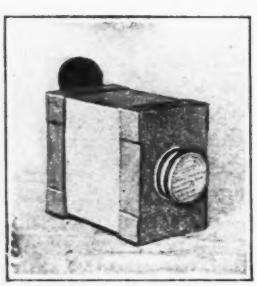
Color Tracing to Keep Ink from Running

IT is always best to color tracings on the back, as the ink lines are liable to run or be obliterated when the color is applied. The colors should be mixed dark enough, so that they may appear in the proper depth on the other side. If the ink or color does not run freely on the tracing cloth, it may be made to do so readily if mixed with a little oxgall.

A Homemade Camera to Make Pictures Without a Lens

THE next time your snap-shots turn out to be failures do not place all the blame on the lens. It depends how you use it. Take a look at the pictures accompanying this article. They were all made without any lens, and in a camera made of common cardboard. The ordinary position of the lens was occupied by a sheet of tinfoil and a pill-box, the tinfoil having a tiny hole pierced with a needle.

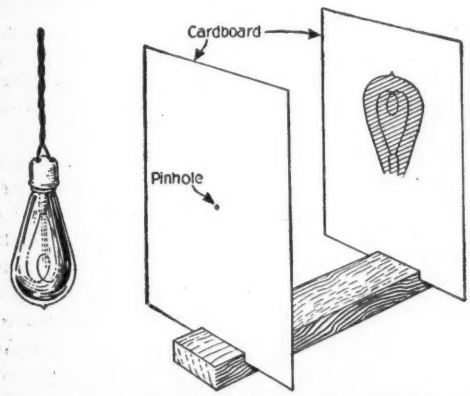
To understand clearly how this was accomplished, make the experiment illustrated. If the room is darkened except for the one light, an inverted image of the lamp filament will appear on the second sheet of cardboard, incidentally proving that light travels in straight lines. From each point on the lamp filament, a light ray passes through the hole, and registers itself on the dark sheet of cardboard. Joining together, these points of light make up the image, its size depending on the distance from the light source, which may be an open gas flame as well as an in candescent lamp.



This lenseless camera can take good pictures

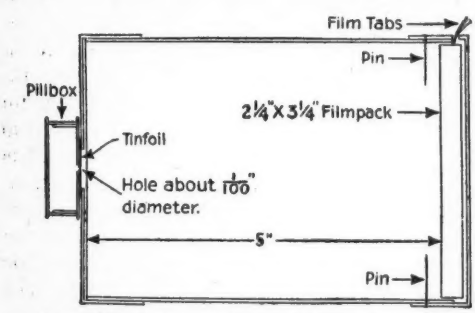
The camera used was built around a film-pack, 2¼ by 3¼ in. in size. The flat films are most adaptable to this makeshift camera and the size is economical. The pinhole should be about 5 in. from the film surface for the best proportions. With a hole less than 1/100 in. in diameter, the exposure for an outdoor picture will be about one minute in

bright sunshine. The pictures of the toy rabbit and the bust were made indoors, with an exposure of 3 minutes in the sunlight, through a window.



An illustration showing how light passes through a pinhole and inverts the picture

A sectional view of the box is shown in Fig. 2. All fastenings can be made with glue except the back cover, holding the film-pack. To keep the film firmly in place, four common pins will work well, care being taken to pass them into the box at the corners in such fashion that they will not enter the pack or lie in front of the film. Care should be taken in punching the hole to make a clean cut opening with a very fine needle. Outdoor views are easy to make, ordinary traffic having no effect on the film. The camera, of course, must be set on some



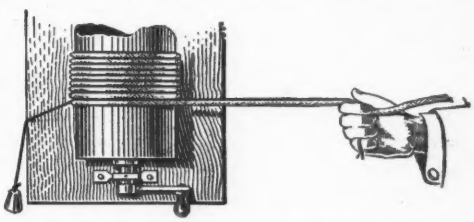
A sectional view of the pastboard box with pierced tinfoil and pill box attached

stationary object, and kept from moving. The length of the exposure necessary to allow light rays to register a picture on the film will not result in having moving objects shown in the finished picture.—JOHN F. MAHONEY.

Spacing the Windings on High Frequency Coils

WIRE for coils on electrical devices may be spaced evenly by the use of a cord run parallel with the wire at the same time. The wire is first attached to the coil and one turn is taken, then the cord or string is tied to the little finger on the right hand and passed over the first finger and across the core. A weight is hung to the opposite end. The cord is laid close to the first coil of wire and the second turn of wire is run on next to the cord, which separates the two turns. The wire is kept close to the cord on the finger just as if winding the wire and the cord on the core parallel and at the same time. As each succeeding turn is wound on, the wire pushes the cord over, thereby spacing the turns evenly.

This method is much better than winding on two turns of wire parallel and



A cord of any size used between the coils of wire for spacing them evenly

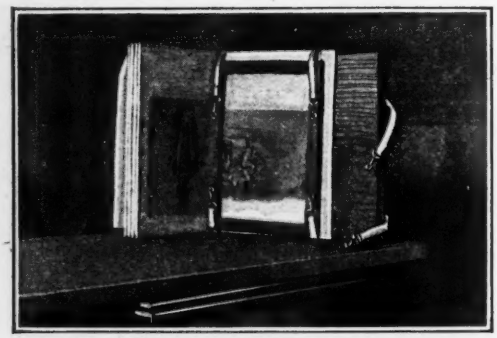
then unwinding one of them to make the space. The winding may be done almost as quickly as one can turn the coil. The spacing is regulated by the size of the cord or twine used.—ODIS REYNOLDS.

Raising the Fluid Level in a Gasoline Tank

ONE day during the boating season I found that I had run out of gas, three miles from the nearest gas station. Knowing that the nipple of the gasoline pipe which leads to the carburetor was inserted about ¾ in. up from the bottom of the tank, I paddled towards the shore, where I looked up some clean, irregular pebbles that were small enough to enter the tank. I dropped them in and thereby raised the gasoline enough to allow me to proceed to the nearest gas station to renew my supply.—W. H. THOMAS.

An Easel Clamp to Hold Copy for Photographing

PERHAPS you have tried to copy a picture from a book or magazine and have found considerable trouble in keeping the page flat and in a position for focusing the camera on it properly. Where the page curves, portions of the picture are sure to be out of sharp focus. Often the leaf cannot be removed from the book or magazine and must be clamped in some way, and when the back is rigid, as in the stapled magazines and many books that are not properly made, the problem becomes annoying.

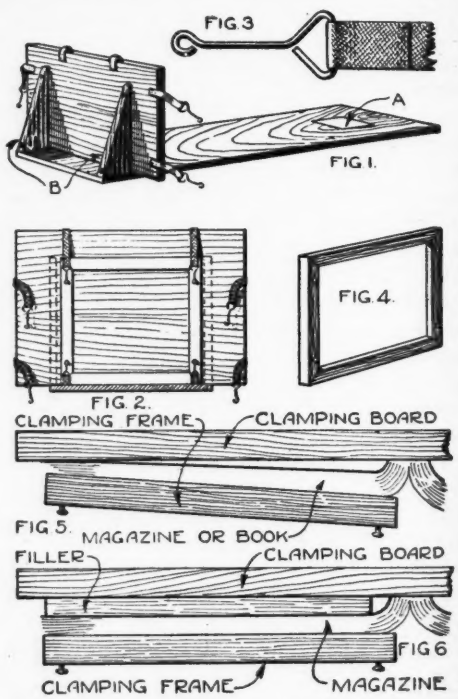


The book page as it is clamped on the easel for making a copy or lantern slide

The device shown in the accompanying illustrations has proved very helpful in making negatives of pictures that may be desired for lantern slides and the like. No attention will be given to the handling of the camera. Its approximate location is shown by the rectangle *A* on the base board in Fig. 1.

A baseboard 3½ or 4 ft. long is the first requisite. This board may be 12 in. or more wide, and while the vertical board is secured at one end and prevents warping, a cleat should be secured fast underneath. A clamping board, to which the book, magazine or loose leaf is secured, may be nailed to the baseboard by driving the nails through it and into the edge of the clamping board. It must be secured in a vertical position so that it will stand at right angles to the surface of the base. Two braces will be needed to keep the clamping board in position. They are shown at B, in Fig. 1. These braces may be long and narrow, but ought to be ¾ in. thick. They must have square corners where they meet the clamping board and base. The braces should be secured with screws.

The manner of clamping the book to the board is shown in Fig. 2. Straps are made of elastic tape with wire loops, Fig. 3, sewed on at the loose ends. The other ends are fastened to the edges of the clamping board with two tacks in each piece of tape. The straps are distributed two at each edge. A rigid frame, Fig. 4, is also necessary. The one shown was made of oak pieces to measure 5 by 7 in. in size from ⅝-in. square stock. Four brass escutcheon pins are driven in part way into the face of the frame, two on each of the 9-in. pieces about 2 in. from the ends. Four other pins may be used, two on each end piece, but this is not necessary. About ⅛ in. of the escutcheon pins are allowed to project above the surface of the wood. The pins may be slanted so that the heads will slant slightly toward each other on each side, which will hold the pull of the elastic a trifle better than if straight. Other sizes of frames may be convenient for smaller or larger pictures.



Details of the parts and their relative location for making the easel clamp

The wire loop, Fig. 3, is made of about No. 14-gage spring brass wire bent with round nose pliers. The shape is not important.

We will suppose that a picture to be copied is on a left-hand page of the book. The book is placed in a vertical position as shown, with the frame pressed against the page and surrounding the picture. Bring up the two loops from below and hook over the lower side escutcheon pins. Bring down those from the top and hook them similarly. The straps should be short enough to give a strain to the elastic, which in turn gives considerable pressure to the frame against the page of the book.

The page will now be ready for exposure. If the book or magazine has a pliable back, so that it will open out flat, the book will not be harmed in the least; but when the back is stiff, as in the case of magazines that are stapled, as in Fig. 5, there will be need of additional backing to bring the pages flat face to the lens. In this illustration the top of the clamping board is seen. The difference between the center of the book and the outside is indicated by *C-D*, the portion that is gripped by the staples or binding. This difference must be compensated for by some kind of backing, such as a board of the right thickness, or perhaps a book can be found that will serve the purpose; something that will bring the pages parallel to the surface of the clamping board as in Fig. 6. This gives a perfect surface equi-distant at all points from the lens of the camera Another magazine may be used in some cases as a filler.

In copying several plates from the same book or magazine, it may be desirable to keep the clamping board in the same relative position to the light. If a picture is to be copied on the opposite page from one that has just been exposed the unclamped pages may cut off the light. In such cases the book may be turned upside down.

When the picture is at right angles to the printed lines, a portion of the book lies on the base of the copying device and the straps from the sides are used instead of those above and below as shown in Fig. 2. The eight straps are provided to meet any contingency that may arise.—C. M. MILLER.

Using a Piece of Gaspipe for a News-Stand Coin Box

A NOVEL coin holder has been devised by a newsboy. He used a pipe about 1 ft. long for holding the

A self-selling news-stand with gaspipe to hold and padlock to safeguard the coins

pennies. The top has been plugged and a nail driven through it. About 2 in. below the top a slot for the pennies has been filed in the pipe. Near the lower end of the pipe a pin passes through it and is locked. To remove the pennies from the pipe, the newsboy unlocks and removes the pin.

Cutting Sheet Iron with a Hack Saw

AFTER breaking four or five hack saw blades while trying to cut a piece of sheet iron in a vise, it was discovered that by holding the saw almost longitudinally to the sheet, instead of at right angles to the flat surface, the vibration of the sheet iron was reduced sufficiently to cut it with ease. The danger of breaking the hack saw blades was also reduced materially.—W. H. THOMAS.

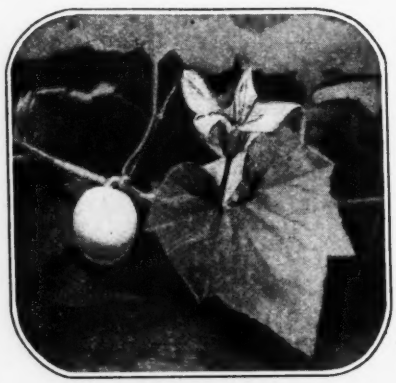
Making Useful and Ornamental Novelties Out of Gourds

ALL of the many varieties of the peculiar and unique ornamental gourds may be grown in the garden. When looking at the fruit, one instinctively feels the possibilities they present for beautiful ornaments or useful utensils. The gourd, when ripe, has a wood-like vine. The natives of the tropics and sub-tropics make saucers and bowls, basting-ladles and water bottles out of them.

We value the gourds for their beautiful quick growing vines, which quickly climb trellises for summer gardens, trees, stumps, etc. These vines cover large areas during the summer months if sown in a sunny spot in a rich fertile soil in the month of May. If kept well watered in the dry summer months absolutely no other care is necessary.

The flowers generally begin to open late in the afternoon and remain open all night until about 9 o'clock in the morning, although they are also open on damp, cloudy and cool days. Bottle gourds and Luffa both have resplendent white flowers, while the flowers of other varieties have a deep, rich yellowish hue.

The profusion and variety of the gourds, which differ as to size, shape and color, may be traced back to degenerate forms. Some of them may resemble apples, pears, eggs, melons, oranges, bottles or clubs. The wart-gourd is especially varied. In color the specimens range from a pure white to a deep orange or from a bright yellow to a dark green. The rind may be smooth, fluted or warted and have two or more colors so arranged as to give a picturesque effect.



The bloom of the gourd and a small gourd on the vine

The specimens chosen for preserving are, naturally, those most origginal and peculiar. When prepared as it actually appears in its natural form it is used either as an ornament for the sideboard or as a garland for decorative purposes. To prepare these gourds properly, an opening must be made large enough to permit a teaspoon to enter freely. Remove the seeds and the soft spongy meat with the spoon, and scrape off as much as possible of the harder meat. The long slender bottle, and club gourds cannot be hollowed out in this manner, therefore a slender rectangular piece of the fruit is usually cut out to facilitate the removal of the internal meat. When the interior of the shell has been perfectly cleaned out, the cut-out piece is glued in again.

Various artistic and useful articles made from the gourd shell and brass or copper strips

The hollowed gourd is then dried. This operation must be performed slowly. The best place is in some warm room, al-

though equal success may be had in the warm autumn sun. Intense heat should be avoided as the gourds are apt to shrivel when dried too quickly. The best way is to secure a box of perfectly dry sand and embed the gourd in it, the gourd itself being tightly packed with sand. The sand which is packed into the gourd should be replaced from time to time with fresh dry sand. Dried in this manner the gourds retain their shape to the best advantage.

The preparation of gourds for utensils and knickknacks is much more simple. Here all those parts which are to be discarded are simply cut or sawed off, the meat removed and the shell dried as described.

The dried gourd can be decorated with carving or by searing designs on it. Miniature paintings are also very effective. A dryer is added to oil paints.

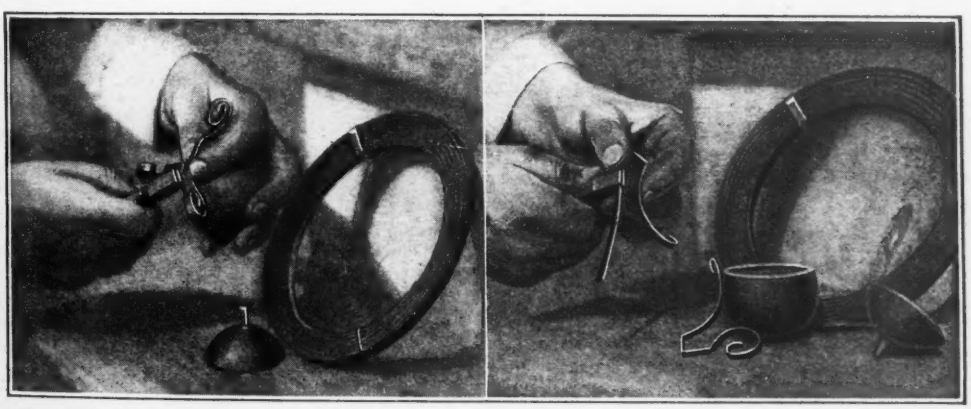
Sawing the gourd and scooping out the pith

Venetian iron work, or bent iron work as it is sometimes called, is very effective when used in conjunction with gourds. Brass, which can be bought by the pound in the larger hardware stores, is sold in flat rolls in all widths and is better adapted for this purpose than iron which is ordinarily used. All that the beginner in this work will need is a pair of flat-nosed pliers and a pair of strong shears. The brass is cut into suitable lengths and bent into scrolls or other ornamental designs. These must first be traced on a piece of paper and then copied. Place the brass over the design frequently to see that it coincides perfectly with the drawing. Last of all, the different pieces are assembled and clipped together wherever necessary to make the network of brass as rigid as possible. Clips are made from strips of brass about ¾ in. in length bent to form the letter U. When placed around a scroll the ends should overlap and the sides fit snugly. The projecting flaps are clinched down tightly when the scroll is in the required position. These clips hold the scrolls firm and steady.

Some gourds, as for instance the club gourds, need no artistic after touches. The lower part of the gourd is sawed off diagonally and the meat removed.

Dry Battery Sealing Compound Used for Wax Imitations

FOR making wax copies of keys or other small designs I have found that the wax on the tops of discarded dry batteries is a very practical and satisfactory substitute when other materials are not at hand. The dry battery wax is prepared by melting it in a cup over a flame or on a stove.



Cutting and bending the metal strips for making the feet or other ornaments to decorate the gourd shell. Strips of brass or copper may be obtained for this purpose from a local hardware store

Mounting Photographic Prints on Glass

USE 4 oz. gelatin, soaked for a half hour in cold water. Place it in a glass jar, adding 16 oz. of water, and put the jar in a large dish of warm water to dissolve the gelatin. Pour the solution into a shallow tray, then have the prints rolled on a roller, albumen side up, and holding them by the corners, pass them rapidly through the gelatin. Care should be exercised that no air bubbles are permitted to form. Press print firmly on the glass. The better the quality of the glass used, the finer will be the effect produced.

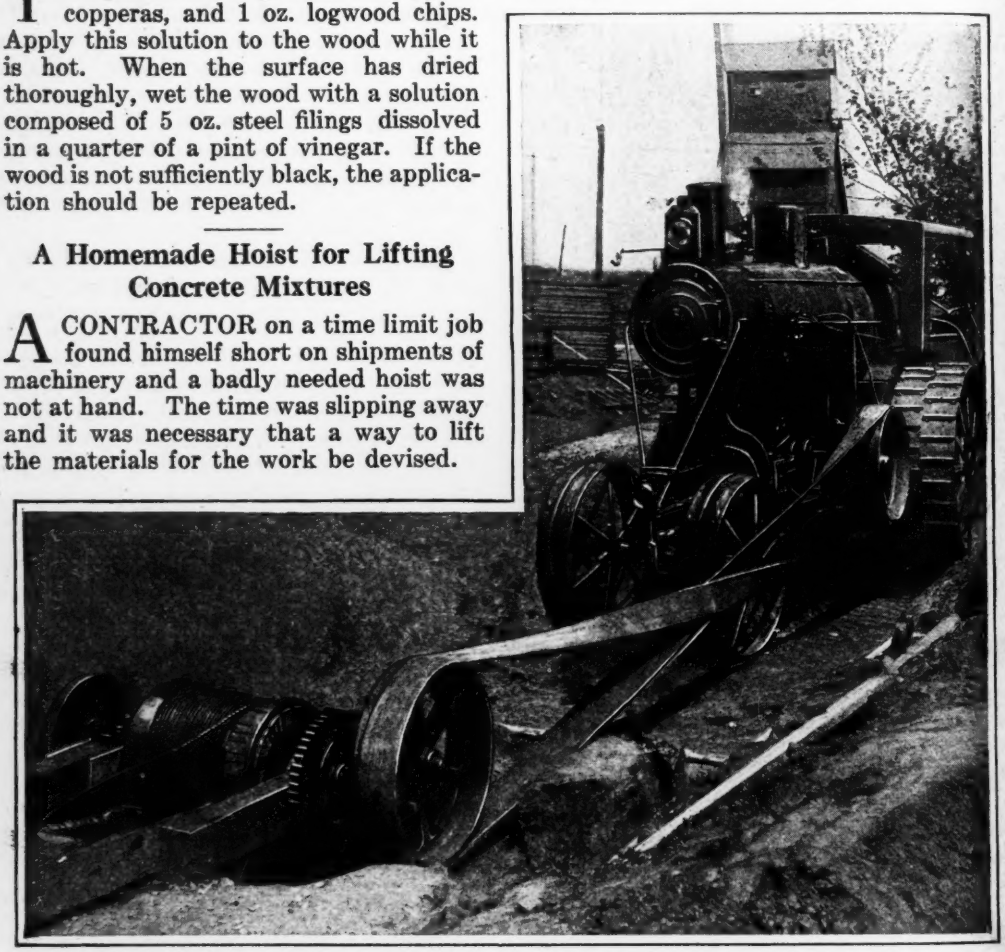
Making a Stain to Give Wood an Ebony Hue

TO a pint of boiling water add ¾ oz. copperas, and 1 oz. logwood chips. Apply this solution to the wood while it is hot. When the surface has dried thoroughly, wet the wood with a solution composed of 5 oz. steel filings dissolved in a quarter of a pint of vinegar. If the wood is not sufficiently black, the application should be repeated.

A Homemade Hoist for Lifting Concrete Mixtures

A CONTRACTOR on a time limit job found himself short on shipments of machinery and a badly needed hoist was not at hand. The time was slipping away and it was necessary that a way to lift the materials for the work be devised.

A local planing mill made a drum for him which consisted of a pine core encased with oak pieces laid on lengthwise. This drum was keyed to a piece of shaft with a gear on one end. The shaft was set in hardwood bearings, bolted to two timbers 8 in. square, which were fastened to stakes driven into the ground. An old pulley with a friction clutch attached was keyed to another shaft, together with a pinion, and set in bearings so that pinion and gear would mesh together properly. A blade was made from a piece of sheet iron and put around the drum and then a foot lever was attached to it. This improvised hoist was driven by a borrowed traction engine to keep the work going until the regular hoist arrived. It was a very satisfactory makeshift.—J. OLIVER HOGG, JR.



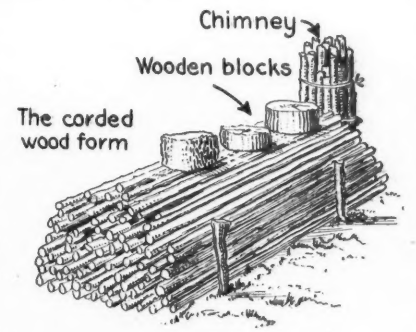
A homemade drum and driving gears for a hoist which were driven by a traction engine and used in place of the regular machine on a time limit construction job

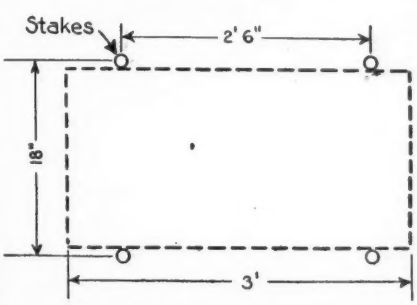
A Camper's Dutch Oven

By J. S. Zerbe

COOKING is always the most difficult problem for the camper. A simple fire made of faggots, a tripod to hold the kettle, or a few stones between which the fire can be built and on which the utensils may rest, are always available for preparing food. But it is just as easy to make a serviceable stove and oven as to adopt either of the foregoing primitive methods. Besides, it is real fun to make such a structure and the device will afford a means for turning out baked potatoes, roasts, and even biscuits without interfering with the cooking in the pans or kettles.

It is especially adapted for localities where stones or rocks are not available, for the material can be found everywhere. A couple of boys can make the stove in two hours, so that the work provides an economical way of putting in time while waiting for the fishing or hunting excursion.





Outline of corded wood

The corded wood form to build the clay over and the ground plan

The size of the oven will depend on the number in the party, although it is well to make it spacious enough, for usually the fuel is plentiful enough for a large oven. The following description gives dimensions for an oven capable of serving two dozen, and at the same time will be serviceable for a half dozen or less.

Gather a quantity of dry faggots, bark, chips, and material of the kind which will easily burn, and let, say, a third of the fuel be green, or partly seasoned. Select four stakes, each 2 ft. long, and drive them into the ground 1 ft., arranging them so that a rectangle is formed, 18 by 30 in.

These posts serve as the holders for the wood to be placed between them. In cording up the wood the dry fuel should be placed at the bottom. The sticks, or the corded pile, should be 3 ft. long, and when laid in should be arched over the top from side to side, care being taken not to pack the wood too tightly, as sufficient room must be left for air to pass through freely from end to end. For this reason leaves should not be used.

When the main cord is complete make a bunch of faggots, also 3 ft. long, and 8 in. in diameter, of dry material, bound in two or three places, so that it will hold together. This is stood up at the rear end, close to the corded pile, and is designed for the chimney.

While the foregoing is being built some of the boys can prepare three drums or blocks of wood, from 6 to 8 in. in diameter, or, better still, three of differ-

ent diameters. One end of each should be cut off square. These should be about 6 in. long, at least. These three blocks are arranged on top of the cord, spaced about 6 in. apart.

Above, the clay laid over the wood; below, the finished stove after the wood is burned

The clay should now be applied. In the selection of this material considerable care should be exercised, as much depends on its quality and the way it is tempered or mixed. Clay is usually found exposed along the hillsides. Either the blue or yellow variety will serve the purpose.

If the camp is located at a lake where the soil is sandy, and the soft, pasty earth, characteristic of clay formation, is not available, the earth should be mixed with the muck or black fine deposit usually found in the bottom of lakes. In either case, or whatever the material, mix it with plenty of water.

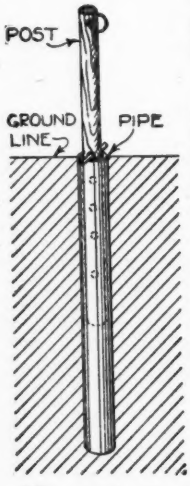
When a sufficient amount has been tempered, cover the corded fuel and the vertical stand with a coating of clay at least 2 in. thick. As fast as the coating is applied follow it up by piling earth against it and tamping it tightly. Be careful to keep the front end of the cord and the top of the vertical bunch of wood free from clay. Every other side and end of the wood should be coated and covered.

As soon as the mound over and around the wood is complete it is ready for firing. The fire will need some encouragement at first, but this is a good thing. Care should be taken not to hurry up the heat. Drying it out with a gentle heat will eventually help the burning. After the fire once starts keep on adding fuel by carefully pushing in faggots. A fierce fire will result. This should be kept up for an hour until a good, strong crust is formed and the blocks on top begin to char through, finally falling into the furnace. The stove is now ready for cooking and baking purposes.

A narrow trench should be dug along the bottom of the fire place, and across this a half dozen or more green sticks may be laid to serve as grate bars. Baking can be done exactly the same as if the dutch oven were being used—that is, by making a very hot fire and afterwards withdrawing it; then, after putting in the articles to be baked, the top, front, and all other openings are sealed up. The heat in the walls will do the work without any likelihood of burning.

A Telescoping Clothesline Post for the Yard

THIS post is for placing in the yard where it can be used for the line on wash day and telescoped into a part that can be set in the ground on other days of the week.



The post enters the ground

The part set in the ground should be 7 ft. long and 1 in. in diameter. Its full length is set in the ground. The pipe to fit in this outer piece is 6 ft. 10 in. long and ¾ in. in diameter. Four holes, ½ in. in diameter, are drilled through the inner pipe into which a small bar of iron is placed to keep it above ground. When the iron pin is withdrawn the pipe above ground falls into the other so that it is entirely out of the way when it is not in use and the lawn is being mowed.—IRBRA H. TAYLOR.

Simple Designs for Sheet Metal Working

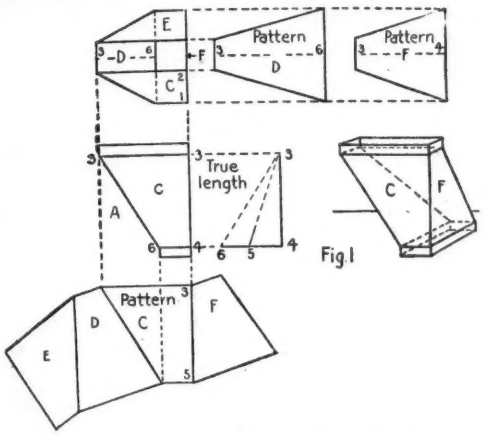
XVI.—Patterns developed by Triangulation

By Arthur F. Payne

Director of Vocational Education, Johnstown, Pa.

THE problems demonstrated in this issue are of exactly the same type as those illustrated in the last issue, the only difference being that they are a little more advanced.

The illustration, Fig. 1, demonstrates the method of developing the pattern

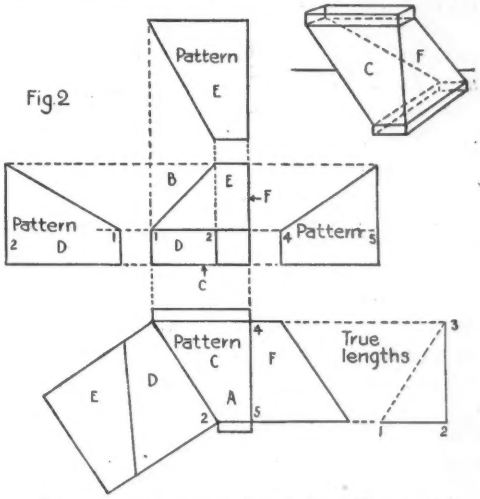


A method of developing a pattern for a compound offset for a hot air pipe

for a "compound offset" hot air pipe by the triangulation method. This offset is used between the floors of a building where the pipe has to be reversed. It is a very simple problem to develop, most of the difficulties being in "visualizing" or seeing the offset from the drawings.

First, draw the front view *A*, then the top view *B*. Second, mark the four sides *C-D-E-F* as indicated. We will first develop the pattern for the side *C*. We must first notice that side *C* of the front view is not a "true view," and that the top is leaning away from us as shown by the distance 1-2 on the top view *B*. To get the true length of the side *C* we must imagine that the line 1-2 is the top view of a triangle, as explained in the last issue. The line 3-4 is the length of the straight side of the triangle. So if we set off on the "true lengths" triangle the distance 1-2 as 4-5 then the dotted line 3-5 will be the true length of the side *C*. Project the width of the top of the bottom down to the pattern *C*, set off the line 3-5 from the true lengths triangle, connect the top and bottom with the long slanting line, and the pattern for the side *C* will be complete.

Now we must get the pattern for side *D*. We can get the true widths of the top and bottom from the top view *B*, as shown. There are two ways to get the true lengths of this pattern, the simplest is to take the length of the line 3-6 from the front view, which is the true length of a line running down the center of side *D*, and set it off as 3-6 on the pattern, then draw the two side lines and the pattern is complete. The triangulation method of getting the true length of side *D* is as follows: Think of the line 3-6 of the top view as the top view of a triangle, set this distance off as 4-6 on the true lengths, we know that 3-4 is the height of the triangle, then the dotted line 3-6 is the true length of the center line, set this off on the pattern for *D*, and draw the two side lines, and the pattern for *D* is also complete. The pattern for side *F* needs no triangulation, the width of the top and bottom are obtained from the top view in the same way

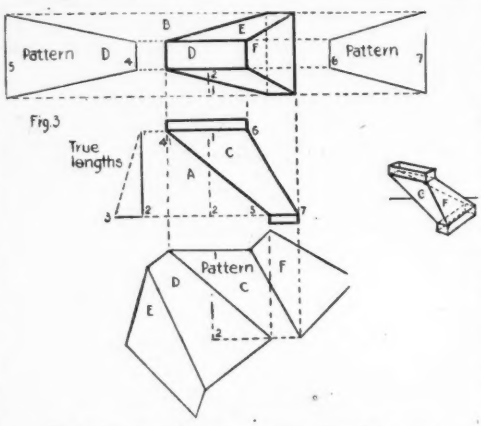


A compound corner offset is here illustrated whose side is developed in two ways

as for pattern *D*. The line 3-4 of the front view is the true length of the center line,

draw the two side lines, and the pattern for side *F* is complete.

The entire pattern for this compound offset is shown. If any of you have difficulty in imagining the shape of this offset place a piece of thin tissue paper over this pattern and mark over the lines with a lead pencil, cut the pattern out, and fold on the lines, and the form of the offset will be before you.



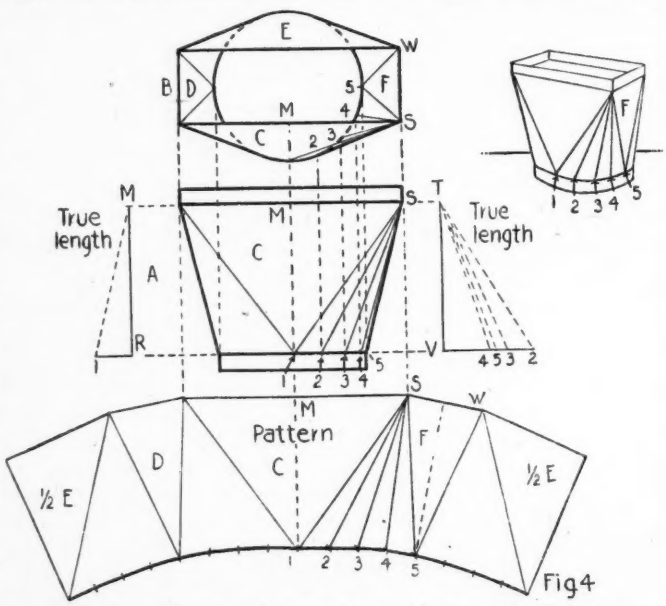
This illustration shows the development for a double offset hot air heater pipe

The illustration, Fig. 2, shows the development of a "compound corner offset." This is where the pipe runs up the corner and then has to reverse. Cut the pattern out of tissue paper and you will see its purpose.

First draw the front view *A*, then the top view *B*. The front view is already the true pattern for side *C*, as it does not incline either way. The pattern for side *D* can be developed in two ways the same as side *D* of Fig. 1. Line 1-2 of the front view is the true length of the length of the side *D*, the width of the top and bottom is obtained from the top view as shown by the dotted lines. The triangulation method is this: think of line 1-2 of the top view as the top view of a triangle, with the height projected over from the front view to line 3-2 of the true lengths. Set off 1-2 of the top view as 1-2 of the true length and the dotted line 1-3 is the true length of line 1-2 of the pattern. The pattern for side *E* is exactly the same as for side *D*. The pattern for side *F* needs no developing. The widths of the top and bottom being obtained from the top view as shown. The line 4-5 on the front view is the true height of side *F* as shown by line 4-5 of the pattern *F*.

The complete pattern for the offset is shown attached to the front view *A*.

The illustration, Fig. 3, shows the method of developing the patterns for a "double offset." The front view is shown at *A* and *B* is the top view. To get the pattern for side *C*, we make use of an interesting device. Notice that we cannot get the length of the center line as we have done in the preceding problems, so we use an "auxiliary line." We have used these lines before in this series. On the front view *A*, we draw the dotted auxiliary line 1-2. Draw the same line in its proper position on the top view as shown. Now think of 1-2 of the top view as the top view of a triangle, and lay it off as 2-3 on the true length. Project line 1-2 of the true length from 1-2 of the front view. The dotted line 1-3 will be the true length of line 1-2. Now project the width of the top and bottom down to the pattern.



A real problem in triangulation will be found in developing a pattern for a single boot for a ventilating pipe

Set off dotted line 1-3 as auxiliary dotted line 1-2 of the pattern, draw the side lines, and the pattern for side *C* is complete.

The patterns for the other sides are developed the same as in the preceding problems, and need not be described. Similar lines are indicated by similar numbers.

The problem, (Fig. 4), of the development of patterns for a "single boot" for a ventilating pipe, is a real problem in triangulation. This so-called "boot" is really a transition piece for a ventilating pipe that changes from round to oblong. Cut the pattern out of tissue paper, and the purpose of the piece will be more easily seen.

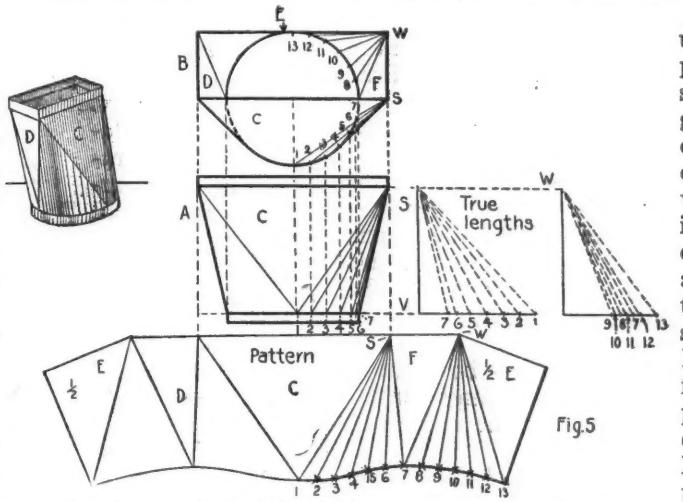


Fig. 5

Another method of developing a pattern for a single boot used as a ventilating pipe wherein the true lengths are found in another way without certain lines

Draw the front view *A* and the top view *B*. Now it will be seen that the boot has four large triangles, one on each side as shown in the sketch. The small triangles 1-2-3-4-5 would not be apparent in the finished boot. It will only be necessary to develop one quarter of this pattern, as all four quarters are alike.

We will first develop the pattern for the large flat triangle *C*. Project the width of the top down to the pattern. Now we must get the true length of lines 1-*M* of the front and top views. The top of line 1-*M* of the front view is slanting away from us. It slants exactly as much as line 1-*M* of the top view is long, so we have the two sides of our triangle and it will be very easy to find the third. Set off line 1-*M* of the front view as line *M*-*R* of the true length; next set off line 1-*M* of the top view as line 1-*R* of the true length; then dotted line 1-*M* of the true length is the true length of line 1-*M*. Set it off as line 1-*M* of the pattern, and draw the line 1-*S*. We could have found the true length of the line 1-*S*, and not bothered about line 1-*M*. In Fig. 5, we shall use that method.

Notice that there is another large flat triangle on the end of the boot, this is marked *F*, but in between there is a curved part that must be developed first. This part can only be developed by considering it as being broken up into a series of small triangles, as shown in the sketch. Then we develop the pattern for each one of these small triangles.

To break up the curved part into small triangles, divide one quarter of the top view circle into four equal spaces, and number the points as shown. Draw lines from these points to the corner *S*. Project the points from the top circle down to the front view of the circle as shown and draw the lines of the triangles to the corner *S* of the front view. Some of these lines are slanting towards us and some are slanting away from us, but the method of getting the true length is the same as we have been using in the preceding problems.

Set off the height of the boot as *T*-*V* of the true lengths; this gives us one side of our triangle. The distance from *S* to the numbered points on the top view circle will give us the other side of the triangles, and we can then easily get the third side as represented by the dotted lines. So set off the distance *S*-2 of the top view as *V*-2 of the true lengths. The dotted line *T*-2 is the true length of line *S*-2. Set your compasses to this distance and from point *S* on the pattern strike an arc. Set a small pair of compasses to the distance 1-2 of the top view circle, and from point 1 of the pattern

strike an arc across the other arc from point *S*. Draw the line 2-*S* on the pattern. Now we repeat this process exactly for lines 3-*S*, 4-*S*, 5-*S*. Then draw the curved line on the pattern connecting these points.

Now we have to get the pattern for triangle *F*. Set your compasses at distance *S*-*W* of the top view and from point *S* of the pattern strike an arc. Notice that the two lines *S*-5 and *W*-5 of the top view are exactly the same; so take the distance *S*-5 of the pattern and from point 5 strike an arc at *W* of the pattern, then take the distance *S*-*W* from the top view and strike another arc from *S* of the pattern. Draw the lines *W*-*S* and *W*-5 and the pattern for triangle *F* will be complete.

Now we need develop no more of the pattern, since the dotted lines down the center of triangles *C* and *F* indicate one quarter of the pattern. Simply lay this one quarter over three times and the entire pattern will be complete as shown in the drawing.

The flange at the top of the boot can be added to the pattern. The flange for the circle at the bottom must be made and put on separately.

The illustration, Fig. 5, of the "single offset" boot is merely a repetition of the development just described for Fig. 4, the only difference being that it will be necessary to develop one half of the pattern instead of one quarter as was done for Fig. 4, also that two sets of true length triangles have been drawn to avoid confusion of lines.

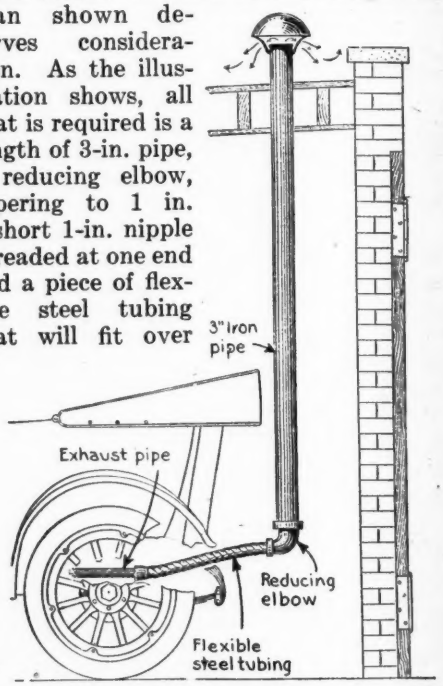
The steps stated briefly are drawn front view *A* and top view *B*. Lay off the top circle into twelve equal spaces, connecting points with points *S* and *W*. Project width of triangle *C* down to pattern, find true length of line 1-*S* by setting off 1-*S* of the top view as 1-*V* of the true lengths. The dotted line 1-*S* of the true lengths being the true length of the line, set it off as 1-*S* of the pattern. Repeat this process to get the true lengths of the other lines, getting the distances between 1-2-3-4 etc. of the pattern from the same numbers of the top circle. The full pattern is shown in the drawing.

Several inquiries having come to the editors of POPULAR SCIENCE MONTHLY and to the author of this series, regarding the methods of developing patterns for automobile parts, such as hoods, seats, bodies, fenders, etc., notice is hereby given that full drawings and demonstrations for the development of patterns for the parts will be given later in the logical place in the series. Any other suggestions will be gladly received.

(*To be continued*)

Simple Way of Removing Waste Gases from the Garage

THE exhaust gases emitted by automobiles in closed garages sometimes cause death. In view of this danger the plan shown deserves consideration. As the illustration shows, all that is required is a length of 3-in. pipe, a reducing elbow, tapering to 1 in. a short 1-in. nipple threaded at one end and a piece of flexible steel tubing that will fit over

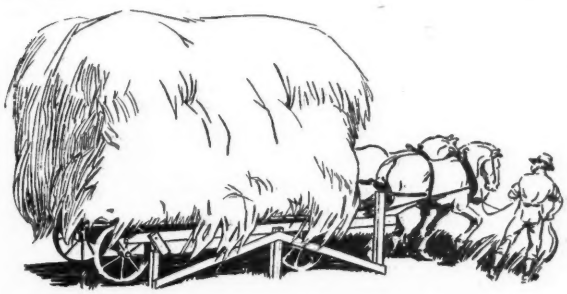


A built-in connecting pipe to carry away exhaust gases from a housed automobile

the end of the nipple and slip over the end of the exhaust pipe in the rear of the automobile. The waste gases are carried by the flexible tubing to the 3-in. pipe, which leads to the outside through an opening in the roof of the garage and has a mushroom cap to keep the rain from entering the garage through the pipe. The location of the pipe may be at the back of the garage or at one side at the front, if the car is driven in and not backed in.—MICHAEL J. F. SCHRAMM.

A Jack Frame for Lifting and Holding a Wagon Rack

IT usually requires three or more men to unload the rack from the trucks or to lift the rack on the wagon. This change must be made at least twice a year and in some cases several times a month. With the device shown it is only a one-man job.



A load of hay being driven on the timbers to take it from the truck

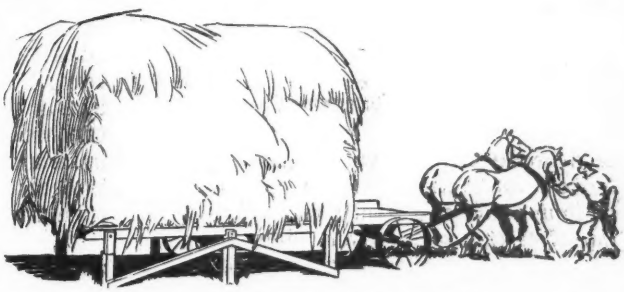
To unload the rack from the wagon, drive in at the low end and the rack slides up the incline and is raised from the trucks. Attach a heavy cleat on each side of the rear bolster so that it will not slide back. The skids are pivoted on the center posts so that when the rack is far enough ahead it will rise from the wagon. The 2 by 4-in. props will then rest directly on top of the short posts and the rack will be set aside until the need arises to use it again.

To load the rack on the wagon, back in at the high end of the device and knock out the swinging props from the short posts. Then pull the rack down on the trucks or the rear bolster.

The device must be made to fit each rack size. Ordinarily the 2 by 8-in. skids will have to be made 20 ft. long. The distance from the center post to the high one will be about 1 ft. more than from the center post to the short post. Brace the posts well with 6-in. fence boards. Set the posts at least 2 ft. in the ground and tamp them well. A little creosote or tar painted over the buried ends will prevent rot or natural decay. —W. E FRUDDEN.

A Rat Trap Made of a Board Placed Over a Tub or Barrel

THIS is rather an improvement on the old tub-of-water rat-catcher. The tub is partly filled with water, and in the center there is placed an upright object, on which the bait, cheese or other food is fastened. On one side of the tub a piece of shingle is attached on a spring pivot, with the thick or heavier part next the edge of the tub. This piece should be short. A piece of lath will do as well as the shingle. A piece of board is laid to the tub to form a path for the rat to walk on. When the rat gets on the shingle and walks towards the bait, down he goes into the water, of course, and his squeals of fright cause other rats to come and meet their fate. We have known of an entire family of rats being drowned in this way, in one night.—A. A. KELLY.



To load the rack on the truck it is backed in between the timbers knocking out swinging props from short posts

Asbestos Covering for Steam Pipes to Save Coal

IN a large wood working factory where a 312 k. w. heating and power plant was used it was found that a saving of 22 tons of coal was obtained by giving the 111 sq. ft. of exposed pipe surface a covering of two layers of asbestos board each ⅛ in. thick and a layer of 85 per cent magnesia covering. The bare pipe gives off 3 b. t. u. per square foot of surface per hour per degree of difference in temperature between the steam and air. This plant lost 88,000 b. t. u. each hour. This reduced to cost of coal per ton gave the amount of tonnage mentioned.

Anchoring a Barrel on a Barrow to Prevent Its Overturning

AN iron hook attached to a cord long enough to permit its being slipped between the staves and over the hoop

The barrel is held to the wheelbarrow bed with cords and hooks to prevent its overturn

of a produce barrel will anchor it to the barrow quite securely. In fact, a series of four cords and hooks will allow a full barrel of this type—even wider than the barrow—to be wheeled up and down hill without danger of its tumbling off. When cleaning up around the lawn or garden a barrel is often more convenient since it holds more than the small garden receptacle. The only drawback is the danger of its falling off, an accident which this holding means will prevent. The cords and hooks can be easily removed when not in use.—JAMES M. KANE.

A Simple, Effective Way to Cut Glass Tubes and Beakers

FIRST, with a sharp triangular file draw a fine line across the tube. Then, holding the two ends of the tube firmly in the hands, bend it, pulling the two ends or halves apart at the same time, and it will crack at the scratch usually with a smooth edge.

If the tubing is thick, it may be necessary after making the scratch, to start the crack by means of a red-hot bit of glass—for instance, the end of a stirring-rod which has been heated over the flame of a lamp.

To cut a large glass tube or beaker the following method is advised: Make a fine scratch by means of a file, wrap around the tube two pieces of damp paper with straight edges facing each other, but a slight distance apart, so as to include the scratch in the gap between. Then, by means of a finely-pointed flame, start the crack at the scratch and carry it around the tube.—PETER J. M. CLUTE.

Guide Blocks to Start Taps in Soft Metals

TAPPING fine holes in brass, copper or lead with the small taps is a very difficult task for the amateur mechanic. Either the tap is broken or the hole is reamed out instead of being tapped. The reaming is caused by not applying the right pressure. When this is not the case the tap wabbles in turning and is apt to be broken. These difficulties may be overcome by following the plan shown in the illustration. This guide will not let the tap wabble and it will apply the right pressure to start it into the hole. All that is necessary for the amateur to do is to turn the tap handle.

The device consists of steel blocks about ¾ in. long, ½ in. wide and 3/16 in. thick. A hole is drilled in each block for a tap size and the hole threaded. When threading a piece of brass, copper or lead, the tap should be screwed in the block

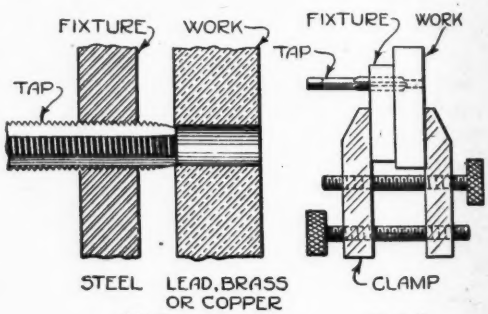


FIG. 1. FIG. 2.

Guide for a small tap to start it in soft metals and keep it straight in the hole

far enough so that the nose of the tap projects just a trifle; then take the piece to be threaded, place the nose of the tap in the hole and clamp the two pieces together. Turn the tap without applying any pressure and it will start and cut the threads straight without danger of reaming.—THEODORE P. GATHMANN.

An Old Truck Becomes an Amusement Thriller

By P. P. Avery

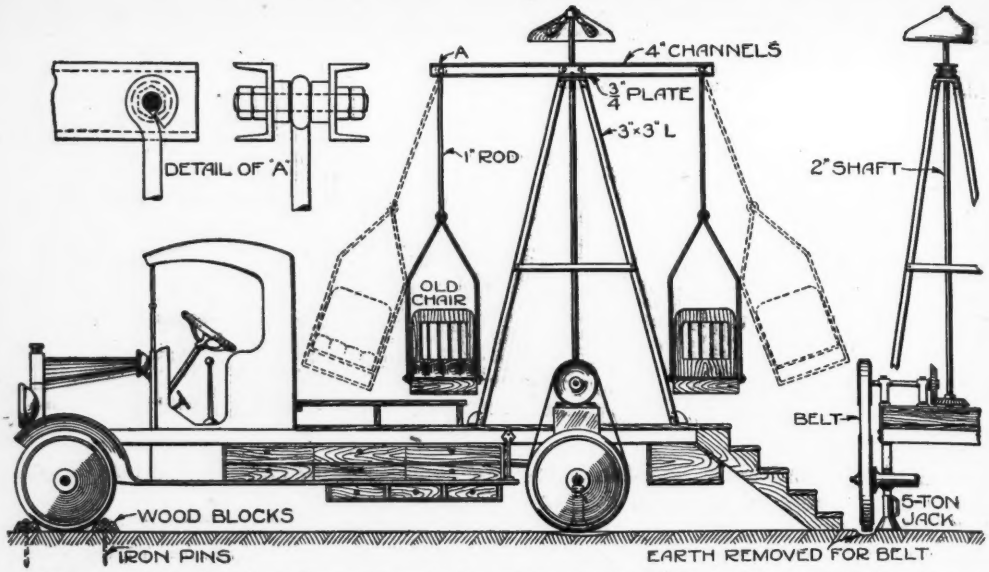
A GOOD second-hand, two-ton auto-truck of reputable make, and the attachment here shown produces a money-making amusement device for traveling from place to place and taking in the country fairs and places of amusement. If there is no cab on the driver's seat, build one and provide side curtains and a wind shield. Under the seat cushion will be found space for an extra set of batteries to be used for emergency lighting or ignition. Tools, oils and greases may be carried in the rear tool box.

Remove the old body from the truck and attach a good strong floor to the frame with sides extending 6 in. Continue the running boards to the rear wheels allowing 6 in. of clearance. Bolt on top of these boards drawers or boxes and attach some more drawers underneath for carrying supplies and provisions. Use a good three-burner gasoline or kerosene stove for heating frankfurters, etc. This is to be located on one side, and on the opposite side is a peanut roaster.

Supplementary to the ignition of the motor add a generator driven from the fan pulley on the crank shaft. This may be done by changing the pulleys to double drive, using round leather belts, one to the fan and one to the generator. From the generator run wires to the headlights and to the lights of the merry-go-'round, and on the side directly behind the cab build a lunch counter which is hinged so that it may be let down during transportation. Attach to the side of the cab vending machines, such as chewing gum, salted peanuts, etc. Provide a special felt-lined box for carrying dishes, knives, forks and spoons.

The frame of the merry-go-'round is built of 3 by 3-in. angle iron with a cross brace in the center of the same material, which is riveted to a ¾-in. plate at the top. The side pieces are made to take down, using ¾-in bolts throughout. Use two lengths of channel iron with 1-in. bolts at each end, over which is looped 1-in. rods which support the two 1-in. rods around the seats, which consists of chairs with the legs removed. The frame is secured to the chassis by ¾-in. rods. Make a set of 5 steps and provide two hooks to fasten them to the rear cross member of the truck frame. Use ⅞-in. pine wood for this construction, also for the boxes, drawers, lunch counter, etc. A frame of ⅜-in. gas pipe is used for supporting an awning or canvas roof over the lunch counters. The rods to slip into the holes in the pipes are bolted to the chassis and secured there with ¼-in. set screws. Old porch awnings may be used for this purpose.

An old mill pulley wheel and two bevel gears with a 2-in. shaft about 11½ ft. long are used for the driving mechanism. Provide set screw washers and heavy brass washers at the top and bottom for the thrust bearing, lubricating with heavy oil. Drill a few holes in the brass so that the oil or grease may be retained. Use a 5-ton jack and raise one rear wheel about ½ in. from the ground. Remove the earth from under the wheel, place blocks with hold-fast irons in front and rear of the other three wheels, driving the 18-in. rods into the ground to prevent



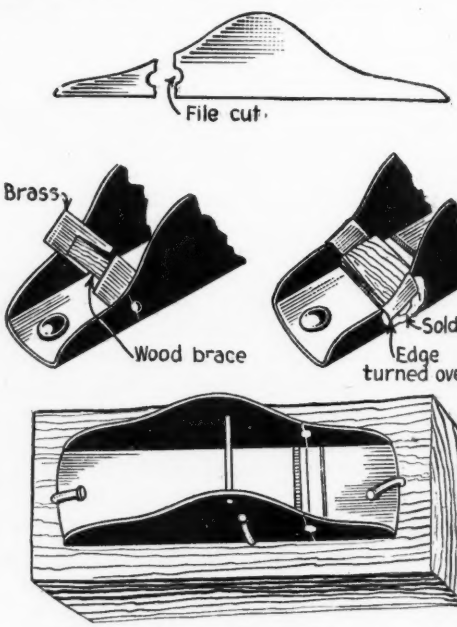
Framework mounted on the rear part of a motor truck which carries a revolving bar with two suspended seats to make swings, all driven by the power plant of the truck

the car from moving, attach a slip on belt 4 in. wide of good leather and operate the merry-go-'round by shifting to low gear and drive the same as if driving on the road. Throttle-down the motor to produce the correct speed for the swing seats. This novel feature combined with the other accessories makes it possible to visit all county fairs, race tracks, parties, etc., and earn good money on the investment. The parts may be bought cheaply second-hand and when completed given a coat of good paint.

Repairing the Metal Body of a Broken Plane

A METAL body plane broken by a fall was too good to be thrown away and it was decided that a repair could be made with the use of solder. The break was in such a place that a cross brace would interfere with the egress of the shavings. Each edge of the fracture was filed with a round file to form a pin of solder, as the inner edges of the break could not be soldered as that would destroy the shape of the plane. The inside and outside surfaces were filed clean and two pieces of sheet brass were wedged in with a piece of wood. Before doing this both surfaces were tinned.

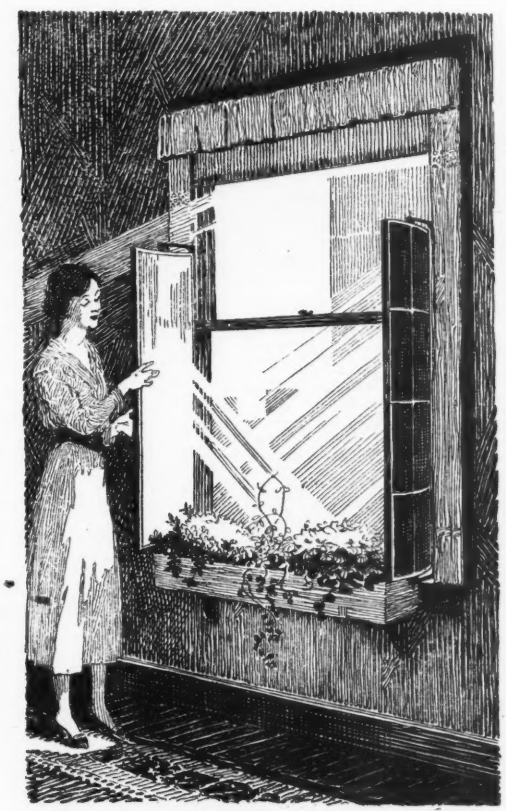
The plane was firmly mounted on a block and fastened with finishing nails. The soldering iron was applied long enough to heat the metal properly to flow the solder, then the upper ends of the brass pieces were turned over the plane edges and soldered. After filing up the edges and solder neatly the plane was as good as new.—JAMES M. KANE.



The break in a plane and how it was prepared to join the parts with solder

Reflector Made of Tin to Cast Sunlight on a Window Box

NOT every window in apartments can face the sun. Sometimes, even when they do, buildings, shading them, keep the light away from window boxes, to the detriment of the growing plants. To provide a means of throwing the sun's rays on the boxes, a reflector made of tin was provided for each side of the window, as shown in the illustration.



The reflectors can be turned to throw the rays of sunlight upon the growing flowers

The reflectors were pivoted at each end so that they could be adjusted to the right angle of light. They were made slightly concave and of tin, polished to make the reflection required. The edges were trimmed with thin wood molding mitered at the corners and the back was braced with cross ribs cut to the curve desired. A coat of black paint was applied over the ribs and the entire back of the tin. A long metal curtain hanger rod was used for the support between the brackets. The ends of this rod served as bearings fitting in round holes in the brackets.

Cleaning the Lime from Gold Fish Globes

DO not use soap or scouring powder to remove the streaks of lime or other mineral deposits found on the top of your gold fish globe, caused by slow evaporation of the water. Soap or scouring powder is injurious to the fish if any particle remains on the globe. Use common salt. Salt is not injurious and answers the same purpose.

Heat-Treating Steel When Doing Experimental Work

IN model building and experimental work it often becomes necessary to harden a piece of steel and temper it to a definite degree of hardness or soften a hard piece such as a spring so it can be drilled or machined, and a few simple experiments in heat treatment of steel are sufficient to enable one to obtain the desired results.

Secure a piece of spring steel wire about 3-32 in. in diameter and 3 ft. long. Heat about 2 ft. of it to a dark red color and allow it to cool slowly in the air. This will anneal the wire so it can be hammered easily. Hammer it flat to a thickness of about 1-32 in. and smooth the surfaces by grinding or filing. Heat the flattened end of the wire to a light yellow color and let the red color extend about 3 in. from the end, allowing a gradual change in color from the end to this point. Cool the wire quickly by dipping it suddenly endwise in water as soon as the desired color is obtained.

With a pair of pliers, or a vise, break off about ½ in. of the end of the hardened piece and notice the grain of the fracture. Break a second piece and compare it with the first, then a third, etc., till the wire bends without breaking, comparing each fracture with the previous ones. You will notice that the part of the metal which was the hottest is always the most brittle and breaks easier than the part which was colder. At some point between these two extremes there is a fracture which is of fine grain and has a

silky appearance. That part of the metal which shows the finest silky grain and is too hard to be filed was heated to the proper temperature.

Repeat the operation this time, trying to heat about 5 in. of the piece to the proper temperature, which is something near 1450 deg., depending on the quality of the steel. This time test the texture of the grain as before and determine whether the proper temperature was maintained to produce the finest grain and hard metal. When the proper hardening heat has been determined and the piece hardened properly, tempering is next in order, that is, reducing the hard brittle metal to a tough pliable state suitable for a spring, punch cutting tool or whatever is desired.

Remove the scale or oxide by grinding or polishing the hardened part of the wire with a piece of emery cloth, soft brick or an emery wheel. Heat slowly about 2 in. of the end and notice the oxide colors as they appear on the surface. As the temperature increases the first noticeable change will be from the original, polished gray to a light yellow, then a straw, brown, purple, blue, etc., till the piece becomes very soft again.

While heating, move the piece about in the heat so as to draw the end to a gray blue and about 3 in. or 4 in. from the end to a light yellow. Between these points the entire color scale will appear and indicates to what degree the particular part was last heated. If the piece was hardened properly the color on the surface indicates the degree of hardness. With a pair of pliers break and examine the pieces as before. In this case it will be noticed that the part which attained the highest temperature is the softest and that the part which has turned to a blue gray will bend easily before breaking. By studying the colors, their corresponding temperatures which are given and the physical qualities of the steel, any desired degree of hardness may be obtained with comparative ease.

Faint Yellow	430 deg. F.
Straw	450 deg. F.
Dark straw	470 deg. F.
Brown	490 deg. F.
Dark brown	510 deg. F.
Purple	530 deg. F.
Blue	560 deg. F.
Gray blue	610 deg. F.

A Clothes Peg Cut from a Limb for the Camper

CAMPERS seldom provide a means of taking care of clothes, but the woods furnish the required material if

A peg made of a Y-branch from a tree and attached to a tent pole for a hanger

one cares to take a little time for the making of a clothes peg. Look around and find a Y-branch on a suitable size limb; cut it so that the arms forming the Y-part are about 3 in. long and the lower end 4 or 5 in. long. The long part is lashed to a tent pole, as shown, and the extending branch makes the clothes peg.

Coloring White Roses Blue with a Chemical Preparation

THIS transformation may be readily carried into effect by submerging the stems of white roses in a solution prepared by dissolving a little more than ½ oz. aniline methyline dye in half a pint of water to which some saltpeter has been previously added. The saltpeter acts as a preservative, and the flowers will last for a considerable time in this condition.

Making a Flying Model Airplane

by Charles H. Hubbell

THE body or fuselage of the model airplane is constructed of spruce sticks 1/8 in. square. The four main beams, or longitudinals, are each 22 in. long. In making the body it is well to lay the four sticks side by side, and mark the places where the struts, or distance sticks, are attached. Then the two sides of the body are constructed, the dimensions being as shown in the illustration. It is a good plan to bind the two rear ends of the two sides together first and then fasten in the sticks at the front end. The longitudinals can then be spread until the other struts are inserted in their proper places. It may be necessary to steam or soak the sticks in water in order to get them to bend without breaking. The sticks are fastened together by means of short pins, the holes for them being bored with a small drill. After the two sides have been constructed and shaped as shown, they are ready to be fastened together. The rear ends should be separated by a stick 1½ in. long, and two sticks, each 3 in. long, should be fastened between the two sides at the front end of the fuselage. The other distance struts can then be inserted at regular intervals.

As the woodwork of the fuselage is now complete, the landing gear is next in order of construction. This part is constructed with a central member consisting of two sets of V-shaped braces connected at their vertices by a straight cross-member. The sticks which go to make up the braces are each 3 in. long. The connecting stick is 4½ in. long. In completing the landing gear, two sticks 3½ in. long are fastened to the fuselage. These extend downward and their lower ends are bored to receive the axle. Two more sticks, each 4¾ in. long, are fastened to the bottom of the rear brace and extend forward to the ends of the axle. The ends of these sticks also are drilled to receive the axle, which is then placed in them. When inserting the axle, the sticks which run from the fuselage down to the axle should be put on the outside, that is, the side closest the wheel. The axle is bent up in the center and bound with fine wire, or strong thread, to the forward brace. The two sticks which slip over each end of the axle are also bound tightly together and soaked in glue. All other joints in the landing gear should be treated similarly. The wheels which are fitted to this model are the 2-in. miniature airplane wheels with pneumatic tires. Axles can be made of strong, stiff wire, such as a bicycle spoke, or they can be purchased from dealers in these materials.

The motor-stick for this model consists of a piece of spruce ¼ in. square and 24 in. long. It is fitted with a hood at one end and a propeller-hanger at the other, as shown. The propeller is made of a block of wood, 10 in. long, 2 in. wide and 1 in. thick. It may be possible for the builder to purchase a 10-in. blank, then the blades can be easily cut out with a knife. The blades should be very thin and slightly cupped, for best results. The propeller-shaft can be made from a bicycle spoke, bent to the proper shape. About 4 oz. of 1/16 in. square rubber is used in this model. This can be purchased from a model supply house; or rubber bands to the required amount may be strung together. After completing the motor-stick, mount it to the fuselage and bind underneath the front and the cross-stick

next to the last one. This is shown at *AA* in the illustration.

When the motor has thus been fastened in, the fuselage may be covered. Bamboo fiber paper is used for this purpose. It is slightly dampened before its application and is then glued to the sides of the fuselage first. The overlapping edges are trimmed close to the sticks with a sharp knife and the whole is then set aside until it is dry. In drying, the paper will shrink slightly, stretching over the sides of the body and making a smooth, taut surface. The top and the bottom of the fuselage are covered as far back as the rear end of the motor-stick so as to give ready access to the hook for attaching the rubber.

While the process of drying is going on, the hood for the front section can be made. The hood only affects the appearance of the machine and is not necessary to a flying model. The large machine, however, is fitted with such a hood enclosing the motors, and it is for this reason the hood is shown. It is cut from light, stiff cardboard, as shown in the pattern. The sides and top are cut from one piece, while the front is cut from another that is semicircular in shape. The flaps on the piece which forms the sides and the top are bent over after the hood is in place. These serve as a foundation to which the front piece is glued. In the corners of the hood at the places marked with small crosses, pins are inserted and are driven into the fuselage-sticks, thus holding the hood in place. Glue can also be used in connection with the pins if desired, and its use makes the hood remarkably rigid and solid. After this part of the hood has been attached, the flaps on the forward end are bent inward towards the center and the front piece is glued to them. The whole hood is then given a coat of shellac, or light varnish, and set aside to dry.

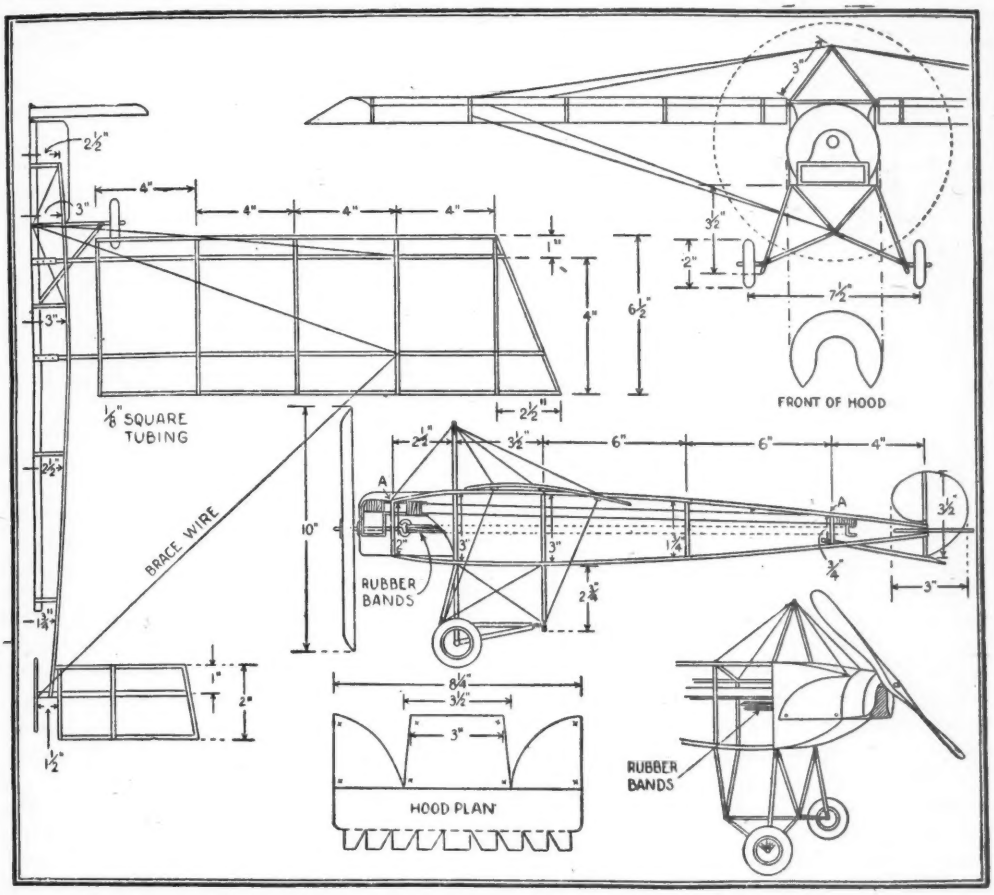
The planes are constructed in two sections, one section for each side of the body. Each plane has two main beams ⅛ in square and 21 in. long. There are five ribs 6½ in. long ⅛ in. wide and 1/16 in. thick in each plane. The curvature for these ribs is obtained by soaking them in water for a short time until they become wet through and then clamping them in a form and holding them in a gas flame until they have been thoroughly steamed. When cool they can be taken out of the clamps and they will hold their curve permanently. The main beams are laid side by side and the places for the ribs marked with a pencil. The ribs are then laid on the beams and tied to them with strong thread. The front beam should set 1 in. back from the front end of the ribs, while the rear beam should be 4 in. back of the front beam and 1½ in. from the rear end of the ribs. The edges of the planes are made from the same size stock as the ribs and are tied to the ends of the ribs in the same way as the main beams are attached. The rear or trailing edge is 19 in. in length and the forward or entering edge is 16 in. in length. The end of the wing is formed of a piece of rib stock, which is bound on top of the plane edges at their ends and is tied to the bottom of the main beams where it crosses them. The main beams are then trimmed off where they project over the end; then all joints are glued and the framework is left to dry.

Now the tail and the rudder are constructed practically in the same manner. A piece of ⅛-in. rattan reed is used for the curved edges of the rudder. The planes, when dry, must be covered with bamboo fiber paper, slightly dampened. They are single surfaced, that is, covered on the upper side only. The paper is cut slightly larger than the framework and the overlapping edges are turned over the plane edges and glued.

The planes are then fastened to the body and the brace wires put in. In attaching the planes the forward main beam is run across the top of the two upper fuselage-sticks while the rear beams is passed underneath these sticks. In this way the planes are given the correct angle to make the machine take to the air from a run on the ground. The main beams are connected by pieces of ⅛-in. square aluminum tubing, as shown in the illustration. The wires used in guying should be about 36 or 40 gage. In bracing the wings care should be taken not to warp them out of shape.

In flying the machine, wind propeller a few turns, so that if the balance of the machine is not correct it can be rectified before any damage is done. The propeller can be wound up perhaps 50 turns for a test and the model set on any smooth,

hard surface, such as a sidewalk, pavement or the like. When the propeller is released, the model should run along on the ground for a few feet and then mount into the air and fly along on a level keep for perhaps 25 ft. If the model does not do this the balance is not right and must be corrected before making further trials. If the machine climbs perpendicularly, or nearly so, and after losing headway, falls tail-first, the main planes should be moved backwards. If the model does not rise at all, either the rubber should be wound tighter or the main frames moved forward a trifle. A little experimenting will soon give the correct position, and then many flights can be made without alteration. A model such as this will fly a di nc o about 100 ft. on 300 turns of he rubber, although it is capable of much longer flights. This model is speedy and fairly steady in flight, provided there is little wind; but because it is speedy, and therefore sensitive, flying it in windy weather is not advisable. The prettiest flights can be made by letting the model rise off the ground under its own power, but flights made in this way are never very long, as a great deal of power is used in the starting. If longer flights are desired, the model can be held on about the level of the eyes, with the right hand holding the fuselage just back of the landing gear, and the left hand holding the propeller to prevent it from turning until released. When released the machine should be given an easy throw forward in a slight downward slant. The model will then glide forward a few feet, pick up speed and fly off.



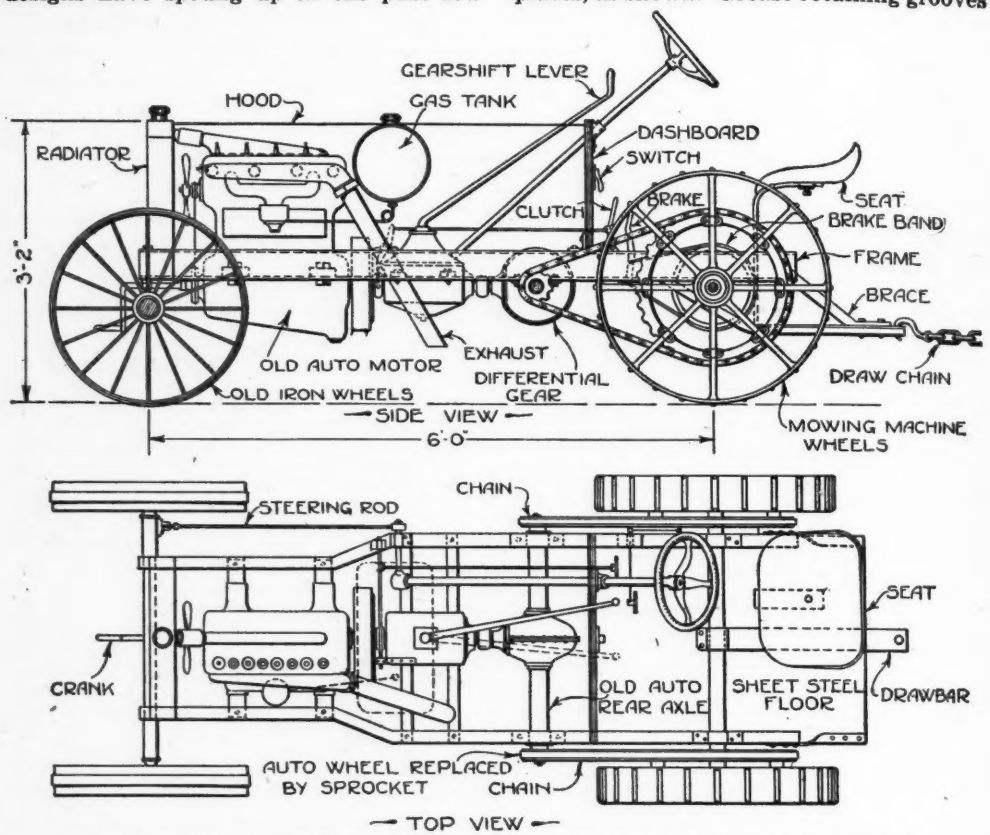
Model flyer details which make a self-propelling machine that will fly in a realistic manner for many feet. The power plant consists of heavy rubber bands

A Farm Tractor Made of a Wrecked Automobile

FARM work is becoming more mechanical as the years pass by and the problem of most interest today is the mechanical horse. Tractors of various designs have sprung up in the past few years, and the farm owner will soon be considered without progressive spirit if he does not own at least one power-operated pulling machine. Some farmers have considered these facts and where they do not have sufficient funds to purchase a tractor they have managed to construct one from discarded farm machinery. These machines can be made as elaborate as the owner desires, using a purchased automobile engine for the power plant. The illustration is that of one in which the power plant was purchased from a dealer who had a wrecked car.

The frame was made of 4-in. channel iron, strongly braced and cross braced with band iron riveted in place. Under this frame the front and rear axles were mounted. These were made of the ordinary heavy wagon axle irons. The front axle was made to swivel on two plates, as shown. Grease retaining grooves were cut in the surfaces of the plates. A 1-in. king bolt of fine steel was used for the axis. The motor and transmission gear case were installed intact, the drive shaft being cut down to engage the differential gear case and the rear axle housings cut and keyways made in the axles to receive the sprockets. The large sprockets were obtained from a junk dealer at small cost and were clamped to the spokes of the mower wheels.

Springs are not necessary as the tractor rides over soft earth. The gasoline tank is held in position by ¼ by 1-in. band iron brackets bolted to the frame.



An old wrecked automobile furnished the power plant for this homemade tractor which, when complete, works as well as an expensive tractor and will draw all farm machines

The gear shift lever is elongated by welding a piece on it and shaping it as shown. A heavy galvanized hood should be made to cover the engine and transmission. If the builder is not familiar with sheet metal work any tinsmith can make it.

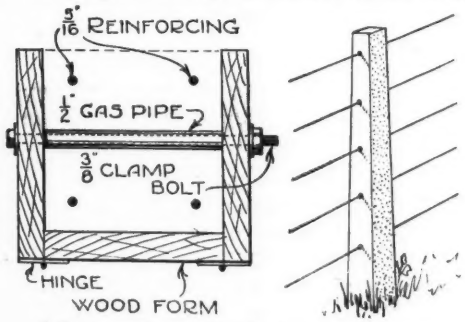
The cutting off of the automobile drive shaft and rear axle ends and the fitting thereto of the sprockets should be done in a machine shop. The draw bar is a 1 by 3½ in. by 4 ft. long iron bar with a ⅞-in. hole for the hook.

The seat is an old mower seat bolted to the frame. The clutch is operated by a push rod and pedal and the brake is made by fastening an old mill pulley wheel to the spokes of the large rear wheels and fitting on a brake band and lever, which should be made of asbestos brake lining riveted to a 1/16-in. band steel and coupled to a ⅜-in. draw rod and thence to a pedal. The engine control should be a fixed spark, and wheel sector placed on the gasoline throttle.

In setting the radiator in the frame, place a piece of heavy spiral spring ¾ in. long under each lug to keep the vibration from fracturing the tubes. This tractor, owing to its decreased gear ratio, will develop unlimited power and with proper care will do much more work than three horses.—P. P. AVERY.

Concrete Posts for Grape Trellis or Farm Fence

IT is an easy matter to make concrete posts for the grape trellis, or farm fence. For a grape trellis make the posts 10 ft. long so that you can set them 4 ft.

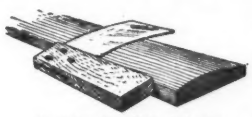


A form made of boards for holding the concrete mixture to form a fence post

underground. The butts should be 6 in. square and the tops 4 in. At equal distances apart through the posts are set ½-in. pipes so that you can run the wires through them. The illustration shows how the forms are made. A ⅜-in. bolt runs through the pipes so that the forms will be clamped well and the concrete will not bulge. Mix the concrete with 1 part cement, 2½ parts clean sand and 3 parts well graded gravel. Place four rods, one in each corner for reinforcing. These bars should be at least 5/16 in. in diameter. For the end posts you should have ⅜-in. eye bolts to run through the pipes in the post. This will enable you to fasten the wires securely and also to tighten them.—W. E. FRUDDEN.

How to Make a Flexible Try Square for Curved Work

A TRY-SQUARE with a flexible blade will be found a desirable addition to any carpenter's kit. Difficulties are always encountered where a piece of work having a concave or convex surface must be marked and cut, and a miter-box is not always available or can be used.



A thin flexible blade for curved surfaces

With the flexible-blade try-square shown in the sketch, such stock as the much-used curved wainscot-cap can be as easily marked as flat stock. "Cupped" or warped lumber, always difficult to work with an ordinary square, can be accurately scored without any trouble whatever. Even many large mouldings and coves can be marked with this square.

The entire expense is the cost of a piece of steel for the blade. The handle is easily made from any suitable hardwood scrap. Procure from a hardware house a strip of No. 26 gage saw-blade steel 2 in. wide and about 4 in. longer than the desired length of the blade. Mark the parallel edges of the blade on this with a fine scratch-awl and trim off the superfluous material with a pair of heavy tin snips, which will be found to cut it very satisfactorily and smoothly, though it will be necessary to file the edges to a perfect true.

The finished blade should be about 1¾ in. wide if it is to be 6 in. long, and ⅛ in. wider for each inch added to the length.

Slot one end of the handle with a thin saw. This slot will be about twice as wide as the thickness of the blade, and in order to fill out the remaining space, a square is cut off the end of the blade piece and doubled on the end of the blade to be fastened in the handle.

Put the blade end of the square in the vise, adjust the blade and handle to right-angle, tighten the vise, and drill three ¼ in. holes through the handle and blade. Insert three soft-steel or brass ¼-in. pins ⅛ in. longer than the thickness of the handle and hammer them until they are firmly set, when the ends can be filed down smooth and flush with the handle.—HENRY SIMON.

An Artistic Combined Sundial and Fountain

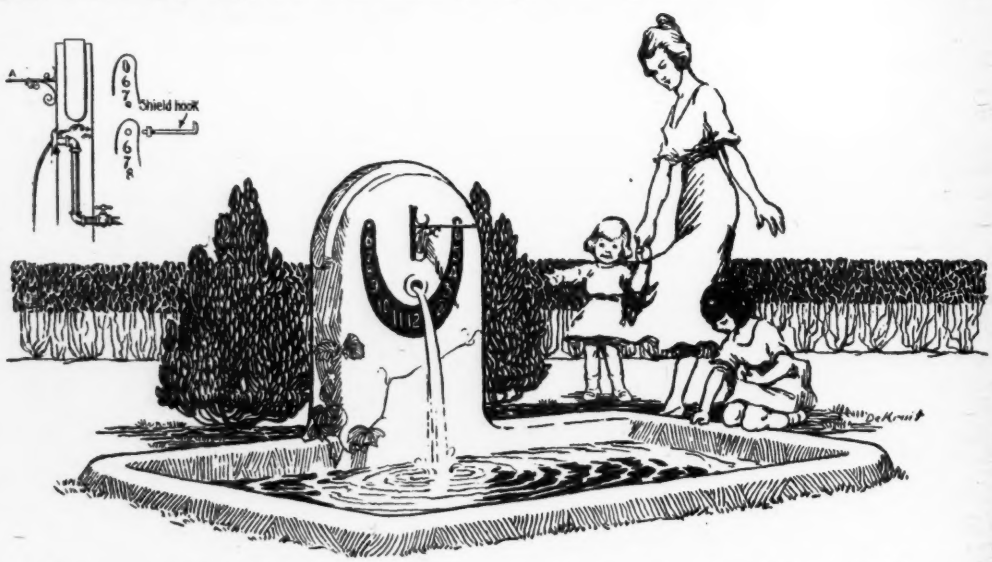
THIS sundial fountain may be easily and inexpensively constructed in concrete. The forms are simple and quickly built and may be further simplified by omitting the cap at the crest of the column. The hand or indicator *A* is made of non-rustable metal and is embedded in the concrete as are also the two hooks that support the upper ends of the metal numeral shield. The figures may be of any good stock design and they are mounted after their true position is proved on a day of good strong shadows. The mounting is easily accomplished with a drill and a small quantity of cement. The rust-proof fountain pipe is of course made with a column form and is provided with a cut-off at its base. The pool, which may be square or oblong in shape, is made of concrete. One side should be extended in the middle to form a column for the fountain.—W. B. SMITH.

How to Make Celluloid Stick on Wood, Tin and Leather

TWO parts of shellac, three parts of spirit of camphor, and four parts of pure alcohol dissolved in a warm water bath, give an excellent gluing agent to fix wood, tin, or leather to celluloid. The glue must be applied when warm to give the most satisfactory results. It should be securely corked when not in use.

Removing Pyrogallic Stains from the Fingers

A STRONG solution of chlorinated lime should be prepared, into which the stained fingers may be dipped for a few minutes. The fingers should then be rubbed thoroughly with a large crystal of citric acid. Apply the lime solution and acid alternately until the stains are wholly removed, and rinse the fingers in running water.



This concrete pool is fed by a fountain in a raised portion of one side on which hangs a sundial. This time-telling fountain must be set at a proper angle for the sun's rays

Electric Devices and How They Work

IX.—Alternating current generator principles

By Peter J. M. Clute, B. E.

IN the consideration of the generation of electrical current, it is first advisable to study the fundamental principles of electromagnetic induction. It has been shown that a current of electricity flowing through a conductor sets up around the conductor a magnetic field, which exists as long as the current flows. On the other hand, if we have a magnetic field, and wish to set up an electric current in a conductor, the wire will have to be moved in such a way as to cut lines of magnetic force. As long as the conductor remains stationary in the magnetic field no current will flow; in fact, even if the wire moves, but in a direction parallel to the magnetic lines, no current flows. Thus, it is found that the conductor must move and cut lines of force in order that an E. M. F. may be induced in it. If the conductor is moved slowly the induced E.M.F. is small. If the number of lines of force remains constant, the E.M.F. generated will be proportional to the speed with which the bar is moved. Thus, if the speed of the conductor remains constant, the E.M.F. will vary directly as the lines of force. Therefore, the E.M.F. of any dynamo can be raised or lowered by varying either the speed of the moving conductors or the intensity of the magnetization of the fields or by both.

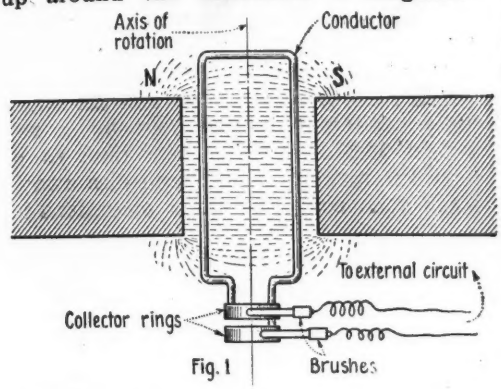
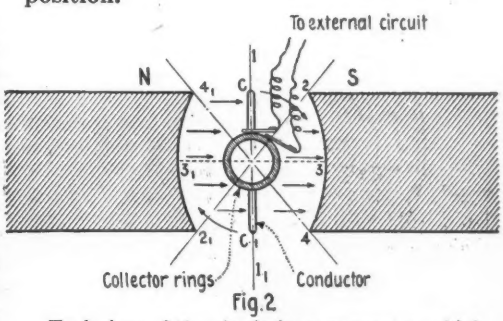


Diagram of an elementary single loop generator with wire ends attached to rings

The E.M.F. induced in a conductor is dependent upon the number of lines of force cut per second. Thus, if a fire cuts 100,000,000 lines per second, an E.M.F. of one volt is induced in it. The total E.M.F. of a generator is the E.M.F. induced in the armature conductors revolving so as to cut the lines of force of a magnetic field. In order to understand more clearly the generation of an electric current in the armature of a generator, let us consider a single loop of wire revolved between the poles of a magnet.

An elementary single loop generator is shown in Fig. 1. The ends of the loop are connected with two collector rings of brass or similar alloy, and brushes bearing upon the latter connect the coil with the external circuit. If this loop were revolved about the axis indicated by the dotted line through the center of it and in the magnetic field, a current would be generated which would be manifested in the external circuit either by heating or by its effect upon instruments placed in the circuit. A clearer idea of the nature of this current and the governing principles can be had by reference to Fig. 2, which represents an end view of the same loop in a vertical position.



End view of the single loop generator which shows clearly the governing principles

In Fig. 2, *C C′* represents opposite sides of the coil, which is revolved in the magnetic field at a uniform rate of speed. It will then successively move to the points 2 2′, 3 3′, and 4 4′ until *C′* is at

the position now occupied by C; in this time the loop will have made one half a revolution. The E.M.F. generated in

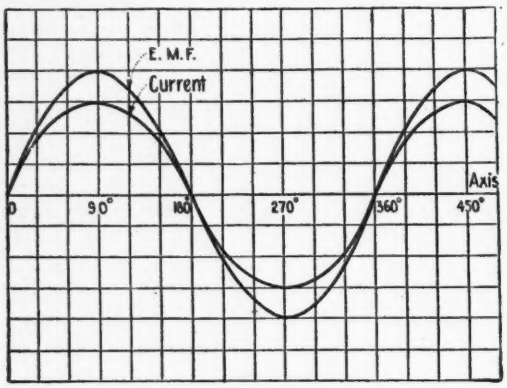


Fig. 3

Curves representing the rise and fall of the current and E. M. F. in an armature coil

the loop is proportional to the rate with which the magnetic lines of force are cut. By referring to Fig. 2, it can be seen that this rate is not uniform, since at position 1 the loop is moving for an instant practically parallel to the magnetic field and is cutting no lines of force. During the time of traveling from 1 to 2, the loop is not cutting nearly as many lines as during the time it moves from 2 to 3. Thus, when the loop is in position 1 1′ no E.M.F. is generated, but as it passes this position it begins to gradualy rise

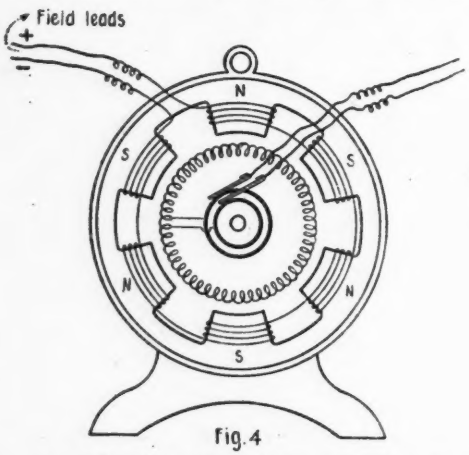


Fig. 4

An alternator with a stationary field outside and an armature rotating with shaft

until C is at 3, when it begins gradually to fall until C is at 1′ when it is again zero. When C moves past the position now occupied by C' the E.M.F. generated begins again to rise, but in the opposite direction, due to the fact that the lines of force are now being cut in the other direction.

The rise and fall of current and E.M.F in an armature coil revolving in this manner can best be illustrated by means of curves similar to Fig. 3. Everything above the axis represents E.M.F. and current in one direction and below the axis in the opposite direction. The current produced is what is called an alternating current, because it alternates through a complete cycle in one revolution of the armature. In each whole revolution there will be an E.M.F. which rises to a maximum and then dies away, followed immediately by a reversed E.M.F., which also rises to a negative maximum and then dies away. Each such complete set of operations is

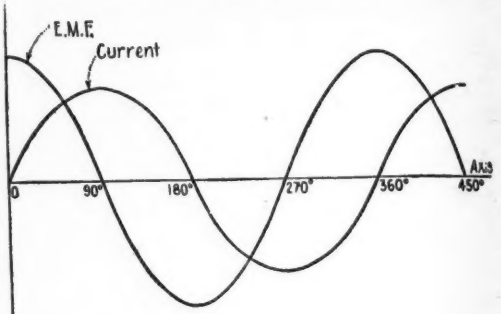


Fig. 5

A curve showing the lag of the alternating current behind the E. M. F. due to inductance

called a period, and the number of periods or cycles per second is called the frequency of the alternations. In bipolar machines, the frequency is the same as the number of revolutions per second, but in multipolar machines the frequency is greater, in proportion to the number of pairs of poles.

In Fig. 4 is shown a sketch of an alternator with a stationary field outside and an armature rotating with the shaft. To secure good insulation, high E.M.F. and sufficient frequency, A.C. dynamos are usually multipolar. The field magnets are fastened to the iron frame and are wound so that they are alternately N and S poles, the field current being supplied by a supplementary D.C. dyna-

mo, called an exciter, or by a separate source of direct current. The armature is made up of thin iron laminations, with teeth around the periphery, assembled on the shaft, the slots forming grooves in which the arma-windings are placed. As an armature coil moves from under an N-pole to an S-pole, the lines of force through it are reversed, and E.M.F. is induced, and this occurs simultaneously in all the coils. The armature windings may therefore be joined together in series, taking care that when thus joined they will act together, and the resultant E.M.F. will be the sum of the E.M.F.'s induced in all the coils. If a low E.M.F. is desired, all the coils may be connected in parallel. In either case, the ends are connected with the two insulated slip rings upon which rest the brushes, which are connected with the external circuit.

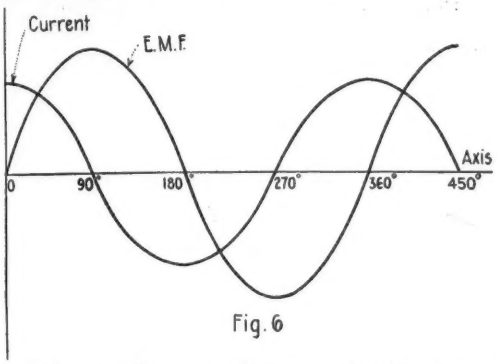


Fig. 6

This curve illustrates the current leading the E. M. F. due to the capacity in the circuit

Since the rotation of the armature with respect to the field is only relative, it makes no difference in the generation of E.M.F. whether the armature or field is made the rotating member of the machine. In either case, the stationary member is always called the stator, and the revolving member is always called the rotor. In large alternators, the armature is stationary and the field rotates within. This construction permits of better insulation of the armature windings in the stationary member of the machine and avoids the transmission of high voltage by sliding contacts on slip rings.

It has been established that self-induction in any circuit causes an E.M.F. contrary to an increasing current and with a decreasing current. In alternating currents, it has a two-fold effect: First, it causes an apparent increase in resistance to flow of current; and second, it causes the phase of the current to lag behind that of the E.M.F. In other

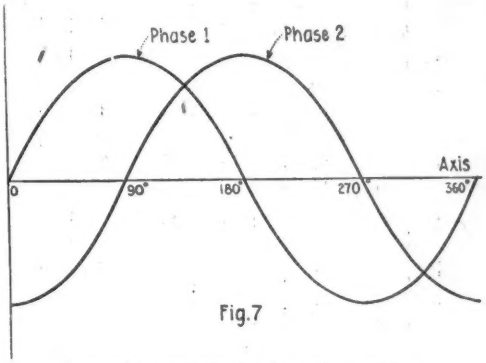


Fig. 7

A graphic representation of two-phase currents is shown in this diagram

words, the current does not reach its maximum value at the same instant that the E.M.F. is a maximum, but a certain fractional part of a period later, which part, expressed in electrical degrees, is called the angle of lag. In Fig. 5 is shown the effect of inductance in a circuit. If we have capacity in an A.C. circuit, the current will lead the E.M.F. in phase, as illustrated in Fig. 6.

In the generation of alternating current, two or more currents of the same frequency of alternation, but differing in phase, may be obtained from one generator. Polyphase currents are

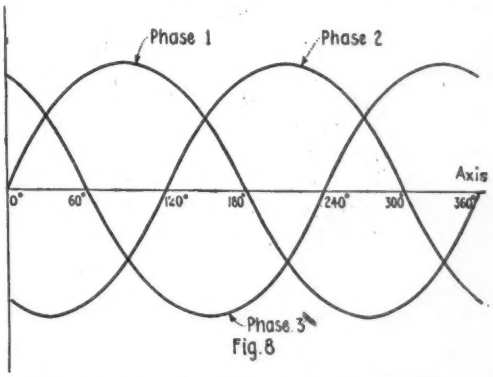


Fig. 8

Currents developed in three-phase alternations are related as shown in these curves

especially useful for the economical transmission of power and for driving induction motors. At the same time they are just as useful for lighting purposes

as the current from a single-phase generator.

In an alternator delivering two-phase currents, there are two sets of armature windings, one set being displaced from the other by half the pole pitch. Therefore, it can be seen, that the two E.M.F's induced in the two sets, while of the same frequency, will differ in phase by a quarter of a period. A graphical representation of two-phase currents is shown in Fig. 7. Referring to the latter, we find that when one of these E. M. F's passes through its zero value, the other will be at its maximum. In the two-phase alternator, four line wires must be used, since each phase is separate in its relation to the other.

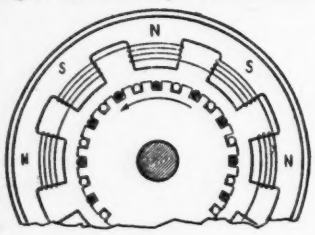


Fig. 9
The armature coils are laid in slots

The three-phase alternator has three distinct sets of armature windings, displaced from one another around the periphery by two-thirds of the pole pitch. Thus, there are induced three E.M.F's of the same frequency and of equal amplitude, which differ by one-third of a period in phase. Three-phase currents require only three lines, and not six, as would perhaps be inferred from previous considerations. Currents developed in three-phase alternators are related as shown diagrammatically in the curves of Fig. 8. In this case, the sum of the currents in any two of the three line wires at any instant is equal and opposite to the current in the remaining line wire. Therefore, the algebraic sum of the three is always zero. Thus, if one end of each winding is brought to a common junction, and the other ends are connected respectively with the three lines, no other return wire is necessary, since each line in turn serves as a return for the other two.

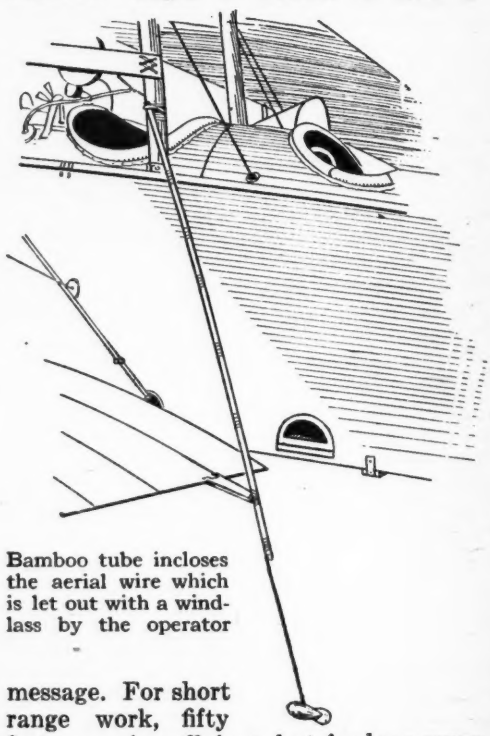
In actual practice the armature coils of alternators are not wound upon projections, but laid into slots as indicated in Fig. 9. Sometimes each slot contains but a single wire; sometimes there are many conductors. The number of slots per pole also varies. For two- and three-phase alternators two or three symmetrical windings are arranged either upon the rotor or the stator. This illustration shows three slots per pole, or one slot per pole per phase, and this armature is designed for three-phase generation. These coils are connected with collector rings in such a manner that in the external circuit they are in opposite directions, one wire always forming the return for the other two.

(To be continued)

How the Airplane Carries the Aerial for Radio Communication

THE aerial is coiled on a windlass in the radio operator's portion of the airplane fuselage, or body, and is run out through a silk wrapped bamboo tube. A lead weight shaped like a torpedo, to hold it nose-on into the wind, is fastened to the end of the aerial to carry it downward.

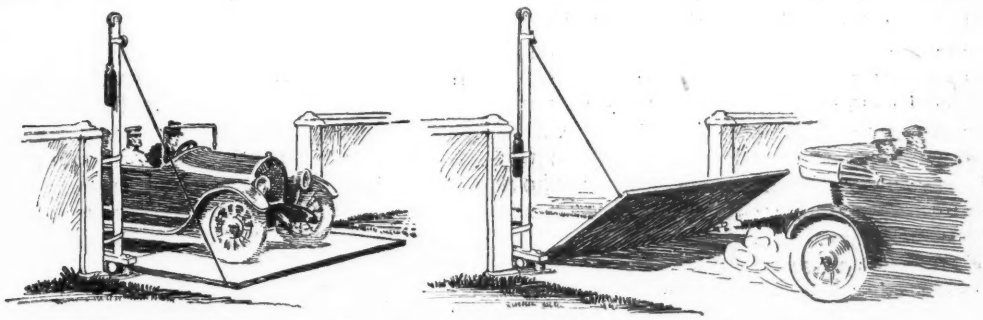
When in the air the aerial is let out to whatever length is needed to send a message. For short range work, fifty feet or so is sufficient, but for long range communications several hundred feet of wire may be used. Whenever the craft is about to land the aerial is drawn in as shown in the illustration.



Bamboo tube incloses the aerial wire which is let out with a windlass by the operator

The Automobile Opens and Closes the Gate Automatically

THE accompanying illustration shows a gate which is automatically opened and closed by the automobile itself, thus making it unnecessary for the driver to stop his car, climb out and open the gate and then stop again and close it behind him. To operate the gate slow down until the car is almost stopped as its spring hangers are about to touch the gate. Then give the car gas and it will go over the gate, which is automatically closed again by means of the counterweight.—JOHN PETERS.



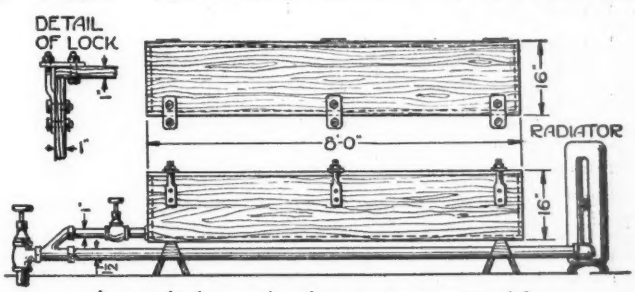
The gate is hinged on the ground and is pushed over by the automobile. A counterweight heavier than the gate raises the latter to an upright position

Restoring the Elasticity of a Paint Brush

SOAKING a hardened paint brush in a strong alkaline solution will soften the paint so that it can be washed out, but it will also soften the hair and render it flabby. This will surely happen if the brush is left in the solution too long. This was what happened to a brush a painter had forgotten, and after washing out the paint he thought he would see what effect vinegar would give to remedy the trouble. After working vinegar into every part of the hair and washing it out in clean water he found that the hair had regained its former elasticity. Of course the acid neutralized the alkali. This treatment is superior to that which calls for boiling water and turpentine.—JAMES M. KANE.

A Steaming-Box Heated by a Shop Heating Plant

THE illustration shows a very cheap, easily installed and practical steaming-box. The idea for making this box arose out of necessity to devise a method of steaming some ash wood to bend for skis for the boys. Such a box may be used for various steaming operations. A radiator was in use in the shop room. The radiator pipe led off about 10 ft. to one corner and was about 6 in. from the floor. A box was made up of cypress lumber 1 in. thick, 16 in. wide and 8 ft. long, and was set over the steam pipe on two trestles. Then with a drainage Y-fitting a branch pipe was run into the bottom of the box. This pipe was provided with a stop-cock, so that when not in use the steam could be turned off. The lid was fastened tightly in the rear with 5-in. hinges and in the front with clamps made of three small iron straps ½ in. thick with holes drilled to fit over bolts projecting from the sides. A box like this can be installed anywhere where there is hot water or a steam radiator or pipe with small steam pressure.



A practical steaming box to prepare wood for bending is attached to the heating system

The Construction of a Simple Parallel Rule

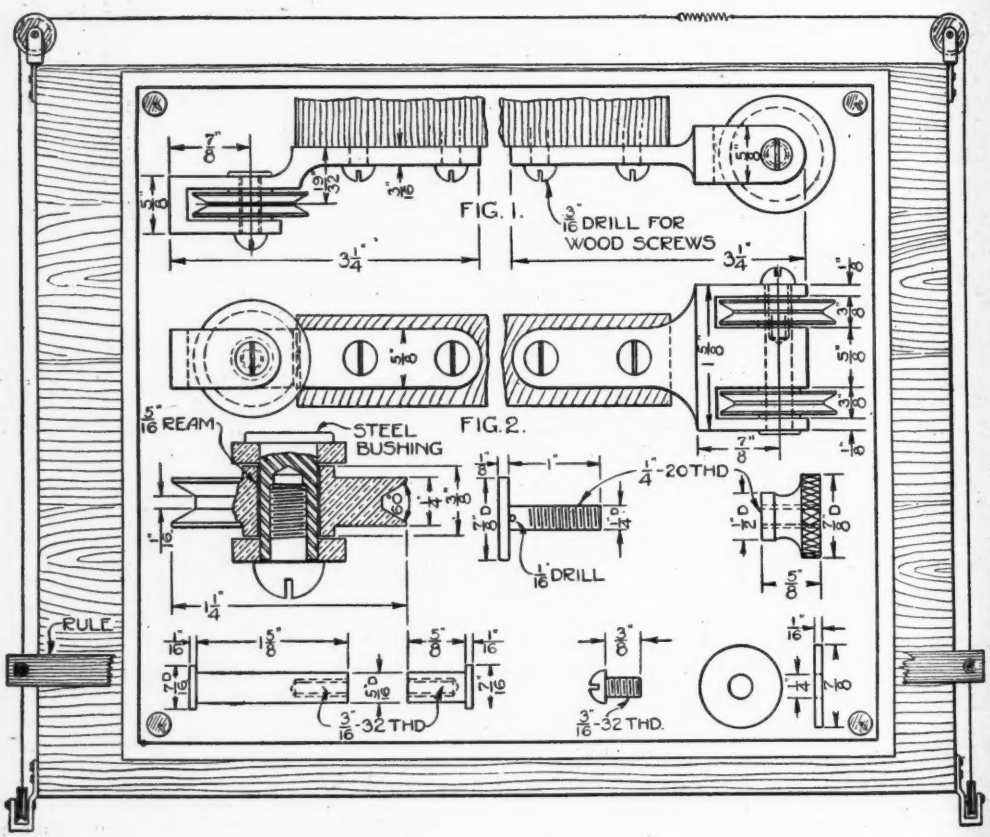
THE ordinary T-square may be of extra fine construction, yet it is almost a nuisance on the drawing-board; for the operator must constantly reach to the left to see if the head is against the edge of the board, and it is almost always necessary to hold it while drawing the lines. The only available substitute is the parallel rule, and the illustration shows the simple construction of one of these rules and how it is attached to the board. It has very few moving parts and they are affected little by wear. If the pulleys are made true, the rule will do surprisingly accurate work without any of the trouble which attends the use of the T-square.

It is not necessary to follow the dimensions accurately except to get the slots the right size, so that the pulleys will not bind. If a neat instrument is desired it should be made of brass and finished to the dimensions given.

Patterns should be made for the brackets, the slots being cast solid and milled out later. If no brass rod large enough to make the pulleys is at hand, a piece of 1⅜-in. shafting about 5 in. long can be used for a pattern, and a piece cast in brass.

The brackets can be finished with a hack-saw, file, and grinder if no milling machine is at hand. The principal dimensions are the distance between the centers of the two pulleys shown in Fig. 2 which is 1 in. and the distance from base-line to the center groove, Fig. 1, which is 19/32 in. These two dimensions are dependent on the bottom diameter of the V-groove in the pulleys, which is 1 in. in diameter.

The bushings are of cold rolled steel shafting. They should be turned to a



Attachments for the ordinary drawing-board to make a parallel rule. This rule is preferable to the usual T-square, which is quite a nuisance on large work

light press fit in the brackets. The hole in the end is drilled, tapped and counterbored till the machine-screw head fits tight against the end of the bushing. The bushing should be flush with the face of the bracket.

The pulleys should be drilled, reamed and turned to about size before cutting them off from the solid rod. Now place the nearly finished pulleys on a 5/16-in. arbor, and turn to the required size. To get the groove right, grind a tool the proper shape, with the exception of the outside face, and use for the finish cut. Try the pulleys on the bushings and if they are too tight, ream with an expanding reamer till they run smoothly.

The "T"-square bolt and thumb-nut may be made as shown in the drawing or cap-screws and hex-nuts used instead. Care should be taken to have the little hole flush against the head or else the washer will shear the string off.

A straight edge is made out of a straight grained piece of wood or from an old "T"-square. It should be about 3 in. longer than the drawingboard.

A spring about 3 in. long is required and can be made by cutting off a piece of a screen door spring.

The best cord to use is "shoe-makers' linen," which can be secured at any shoe shop. Get the heavy kind used for sewing soles and do not wax it.

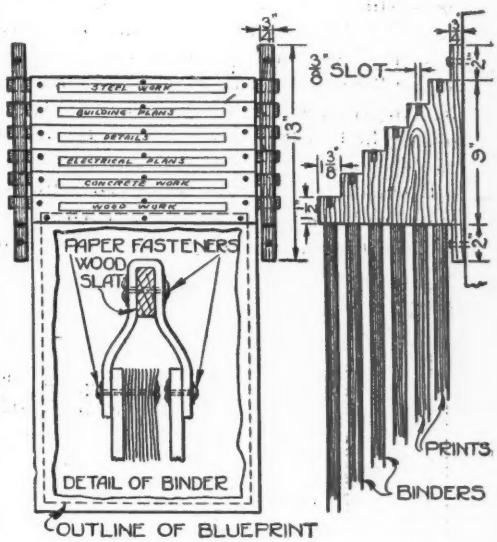
Put the device on the board, as shown in Fig. 1. The brackets should be securely attached to prevent any slight movement. The strings that go across the top of the board, cross between the pulleys. Those on the sides run parallel. With the spring inserted in one of the top cords the entire cord system becomes continuous. The "T"-square bolts are strung on the top cord, on both sides of the board. Measure the distance between the cords on the sides and drill holes in the straight edge, to this dimension large enough for the bolts to go through easily. Put a washer on both sides of the straight edge and screw up the thumb-nuts. Adjust the position of the spring so that it is in the center when the straight edge is in the center of the board.

The straight edge may be set at any small angle by loosening one thumb-nut and sliding up or down.

A Handy Blueprint Binder and Filing Rack

IN most offices of drafting-rooms where many blueprints are constantly used for reference a system is needed to keep track of the prints. If they are left promiscuously in the drafting-room it is difficult to find the one you need in a hurry.

A neat way of filing the prints is shown in the illustration. Two wooden racks



Binding office blueprints and filing them in a handy rack for ready reference

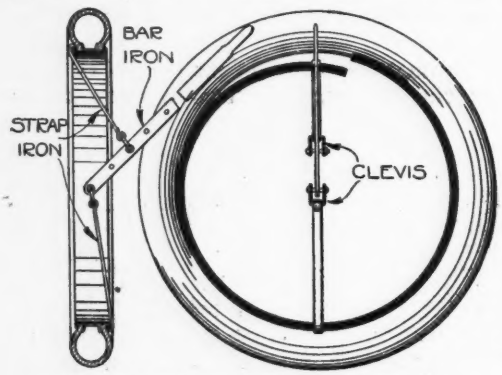
are cut as shown in Fig. 1, and are fastened to the wall with four wood screws. The distance between the racks will depend upon the width of the blueprint binders used. In Fig. 2 is shown the detail of the blueprint binder. The stiff covers are of cardboard and are covered with black cloth to give them a neat appearance and to enable them to withstand the frequent handling.

The paper fasteners hold the cover to the leather or any other flexible material. The covers will bind the blueprints together. A slot ¼ in. by 1 in. is riveted or fastened with paper fasteners in the upper part of the hanger.

These binders may be indexed as shown in the drawing. They, together with the rack, will be found as serviceable as more costly ones.—FRANK HARAZIM.

A Contrivance Which Will Remove Your Tire with Ease

THIS simple tire remover is made from two pieces of ⅜ in. strap iron 1 in. wide and 14 in. long and a piece 4 ft. long, 2 in. wide and ½ in. thick. The latter piece is used for the lever to which the



A lever toggle for drawing the rim from opposite sides so as to remove the tire

other two pieces are attached with clevises. The center clevis straddles the lever and the pin is inserted through a hole to make the length suitable for the rim size. Several holes are bored in the lever for these adjustments. The end of the lever is shaped so as to make a bearing for the end clevis.

An eye is shaped in one end of each piece of iron to take the clevises. The opposite ends have a hook to catch in the rim edge. The rim is stood on the floor or ground and the irons hooked into opposite sides of the rims, one at the top and the other at the bottom. The tire is released by pressing down on the lever.—LAWRENCE F. ASHLEY.

Cleaning Glass Surfaces Without Leaving a Stain

THE best method to clean glass—for instance, the interior of a bulb or flask—is to wash it in turn with chromic acid, distilled water, and alcohol. Sometimes a mixture of alcohol and ether is used in place of the alcohol alone. Caustic potash or soda will clean certain things; but they themselves adhere to glass, and must be removed by a most thorough rinsing with water.

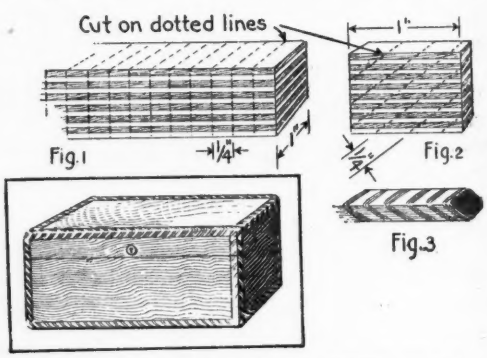
In some cases it is necessary to use hydrochloric acid, or even nitric acid, but this rarely happens. If nitric acid is employed, the operation should be carried on under a hood, so as to remove the noxious fumes.

Chromic acid, as used in the first method, consists of 10 parts water, 1.5 parts potassium bichromate and 4.5 parts sulphuric acid. It may be used over and over again for cleansing purposes.

An Effective Use of Veneer on Gift Boxes

SMALL gift boxes or chests are favorite articles with the amateur craftsman. A distinctive touch may be added to these boxes by the use of veneers in making an inlaid variegated border around the edge of the box. There are several operations in preparing the veneers, but they are not difficult and the result will pay one for the time spent.

Secure from any furniture factory or at a mill some scrap or a piece of veneer of any variety of wood. Cut this into strips 1 in. wide (any length), glue with thin cabinet glue, placing alternate strips of light and dark wood together as in Fig. 1. Saw these into sections ¼ in. thick as in Fig. 2, then saw these sections diagonally into strips ¼ in. square as in Fig. 3. Square the ends of the

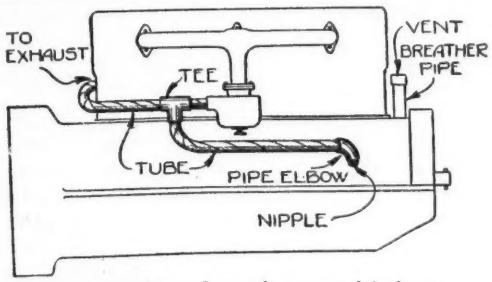


Manner of cutting strips of veneer to set in grooves for making inlay work on wood

strips. Groove the top, bottom and front edges of the box a little less than ¼ in. deep, being careful to make the cut straight. Insert the pieces and glue them in place, keeping all joints true. With a sharp plane work them down flush with the box surface. Round all edges and finish with fine sandpaper. The result is a pretty box.—GEORGE L. FURSE.

A Homemade Fuel Saver Attached to Automobile Engine

FOR making and attaching this fuel saving device drill a 1-in. hole in the upper part of the crank case on the same side of the motor as the carburetor and as near the breather pipe as possible.



Pipe connection of crank case with heater on the exhaust for making a fuel saver

If the breather pipe is one of the kind fitted with a tight cap a ¼-in. hole should be drilled in the cap to form a vent so that a vacuum is created in the crank case. Next tap the hole in the crank case and screw in a piece of pipe about 1½ in. long. Solder over the end of this pipe that goes into the crank case a piece of fine screen. Now secure a piece of 1-in. flexible tubing, such as is used in connecting the carburetor to the exhaust manifold. Fasten one end of this tubing to the pipe screwed into the crank case. The other end must be brought up to the air opening of the carburetor and fastened to it, but in such a way as not to interfere with the free flow of air. A good way to do this, if your carburetor is fitted with a hot-air pipe to the exhaust manifold, is to cut this pipe near the carburetor and fit a tee as in the illustration. After this has been done your saving device is finished and it will draw all of the explosive vapors from the crank case through the carburetor into the motor in the form of gas. After you have installed the device start the motor and let it warm up. You will soon notice that your motor is getting a very rich mixture. This is due to the vapor being drawn from the crank case. Close the needle valve on the carburetor until the motor runs as usual. In cold weather keep the carburetor choker closed a few seconds longer than usual, until the motor warms up slightly.—W. D. THOMPSON.

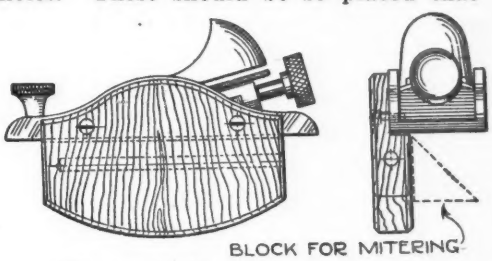
Making a Block Plane Into an Edge-Trim Plane

FOR accurately squaring long end-grain edges, such as the side of a table, an edge-trim plane is a great convenience. It is almost a necessity where the edge to be trimmed is not square but beveled.

Here is a way to make your block-plane instantly convertible into a very efficient edge-trim plane at no expense and with only half an hour's work:

Take a piece of hardwood, preferably maple, applewood, or rosewood, 4 in. wide by 2½ in. long, and along one end-grain edge form a rabbet ¼ in. deep and as wide as the extreme height of the sides of the plane. Be sure that the face of the rabbet is smooth and parallel with the sides of the block. Put the block with the rabbet against one side of the plane, mark the outline of the side, and cut it out with a coping-saw. Saw the other end of the block out in a semi-circle, and round off all exterior edges. Bore a ¼-in. hole through the entire width of the block ½ in. below the rabbet, and drive into this hole a pin tightly fitting it, and which can be easily cut from a large spike. The purpose of this pin is to prevent the block from breaking if it should be accidentally dropped.

Through the sides of the block, about 1 in. away from the edges, drill two small holes. These should be so placed that



The fence as it is attached to the side of a block plane to make an edge plane

when they are continued into the side of the plane, they will emerge just above the bottom. Thread the holes in the plane for machine screws or stove bolts.

It only takes half a minute to screw this attachment into place or take it off again. The wide, rounded block furnishes a firm and convenient hold for the hand so that it is easy to keep the plane

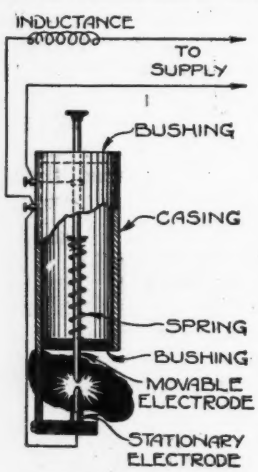
perfectly square with the work. For miter or bevel work, it is only necessary to screw wooden blocks of the proper shape against the inner face of the block.

This attachment does not interfere with the ordinary use of the block-plane in any way nor do the screw-holes weaken or deface it. Furthermore, the fence can be made attachable to either side of the plane, by providing screw-holes in both sides. Again, the wooden fence slides over the work with a minimum of friction, performing the task assigned to it with perfect ease as well as absolute accuracy.—HENRY SIMON.

An Electric Gas Lighter for the Laboratory or Factory

IN laboratory and other places where gas is used at frequent intervals, a simple electric gas lighter is not only a necessity but also a convenience.

The casing of the lighter described is of hard rubber or fiber, sawed as shown in the diagram. The bushings are preferably of the same material, or can be made of impregnated hard wood. The movable carbon electrode is fitted with a knob and is kept separated from the stationary electrode by a spring clamped to the carbon as shown.



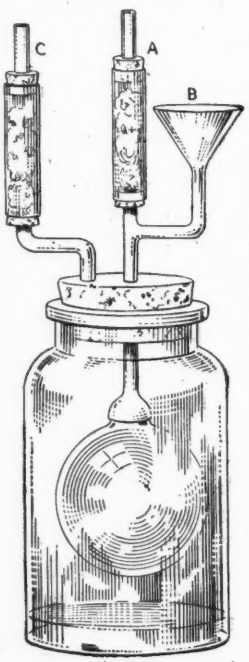
Fiber barrel with electrodes for making a small arc

Connections are given in the diagram. The inductance coil is used on A. C. circuits and a resistance coil on D.C. circuits. The inductance can be varied by the number of turns required for different frequencies; it can be made by winding a number of turns of insulated wire around a soft iron core.

Pressure on the knob brings the two electrodes into contact and upon relieving the pressure a little an arc is started across the gap, sufficient to ignite the gas.—PETER J. M. CLUTE.

How to Protect a Soap Bubble and Keep It for Weeks

LASTING soap bubbles cannot be made unless the air inside and outside the bubble is almost free of dust particles and is saturated with moisture. Wherever you are the air is dust-laden so that the whole blowing apparatus must be conducted inside of a large cork. It is necessary to pass two glass tubes through the cork into which larger sections of glass tubes are placed, as shown in the illustration, which inclose cotton wool filter. The soapy water and air enter through the tube, *A*, the liquid entering the by-pass tube, *B*, below the air filter. The other tube, *C*, is to allow the displaced air to leave the bottle. This tube also provides for air movements due to variations in temperature and barometric pressure. A small quantity of water, *D*, is placed in the bottom to keep the air moist.



A large bottle inclosing an air bubble

A Reliable Solution for the Electro Deposition of Aluminum

ALUMINUM is at best an uncertain metal with which to make an electro deposit. The following formula, however, has been found to be quite reliable. Dissolve 50 parts by weight of alum in 300 parts of water, and add 10 parts of aluminum chloride. The resultant solution is heated to 200 deg. F. and permitted to cool. When cold, 39 parts of cyanide of potassium are added. When plating with this prepared solution it has been found best to use a feeble current.

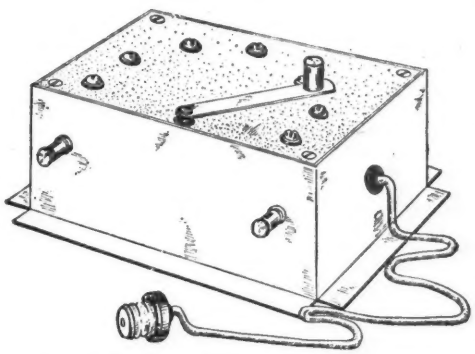
Making a Toy Transformer

A simple method of making the now much used bell-ringing transformer

By W. A. Hirsch

THE transformer described in the following article is known as a toy or bell-ringing transformer of the shell type. It can be attached to a lighting circuit of 110 volts and the current stepped down to 12 volts. It is used for ringing bells, running small electric motors, miniature lights, railways, etc. Building it will prove instructive as well as enjoyable for the young electrician.

It will not be necessary to go into detail with regard to the magnetizing and demagnetizing of a soft iron core when placed in a magnetic field that is produced by alternating current, as such terms and description probably would tend to confuse rather than assist in the construction of this simple transformer.



The toy or bell-ringing transformer of the shell type encased in a neat box

The transformer in general consists of a primary and secondary coil, in the center of and surrounding which are a number of laminations of thin soft sheet iron. The dimensions of the laminations are given in Fig. 1.

These strips are 11½ in. long and ¾ in. wide and enough of them are cut to make a pile ¾ in. high when tightly pressed together. They are then given a coat of very thin shellac. Cut two washers from a piece of insulating fiber 1-16 in. thick to correspond with the dimensions in Fig. 2. Cut from soft wood four pieces 2⅞ in. long with a cross-section as shown in Fig. 3.

Pile the shellacked strips up, and slide one of the fiber washers on them to within 4¼ in. from the end of the core, then the other washer to within the same distance from the other end, leaving a space of 2⅞ in. between the washers. Now place the four strips of wood between these washers on each side of the core and fasten in place with several layers of heavy insulating cloth or linen strips which have been first dipped in thin shellac. When this is done the core is ready to receive the coils.

The low tension side of secondary will have the larger wire and the smaller number of turns and will be wound on the core first. Secure about 5 oz. of No. 24 gage single cotton-covered wire and solder about 6 in. of No. 18 double cotton-covered wire and pass through a hole drilled in one of the washers as near to the core as possible. By allowing a drop of solder to form on the joint and pulling the heavy wire through the washer up to the drop of solder the joint will be made secure.

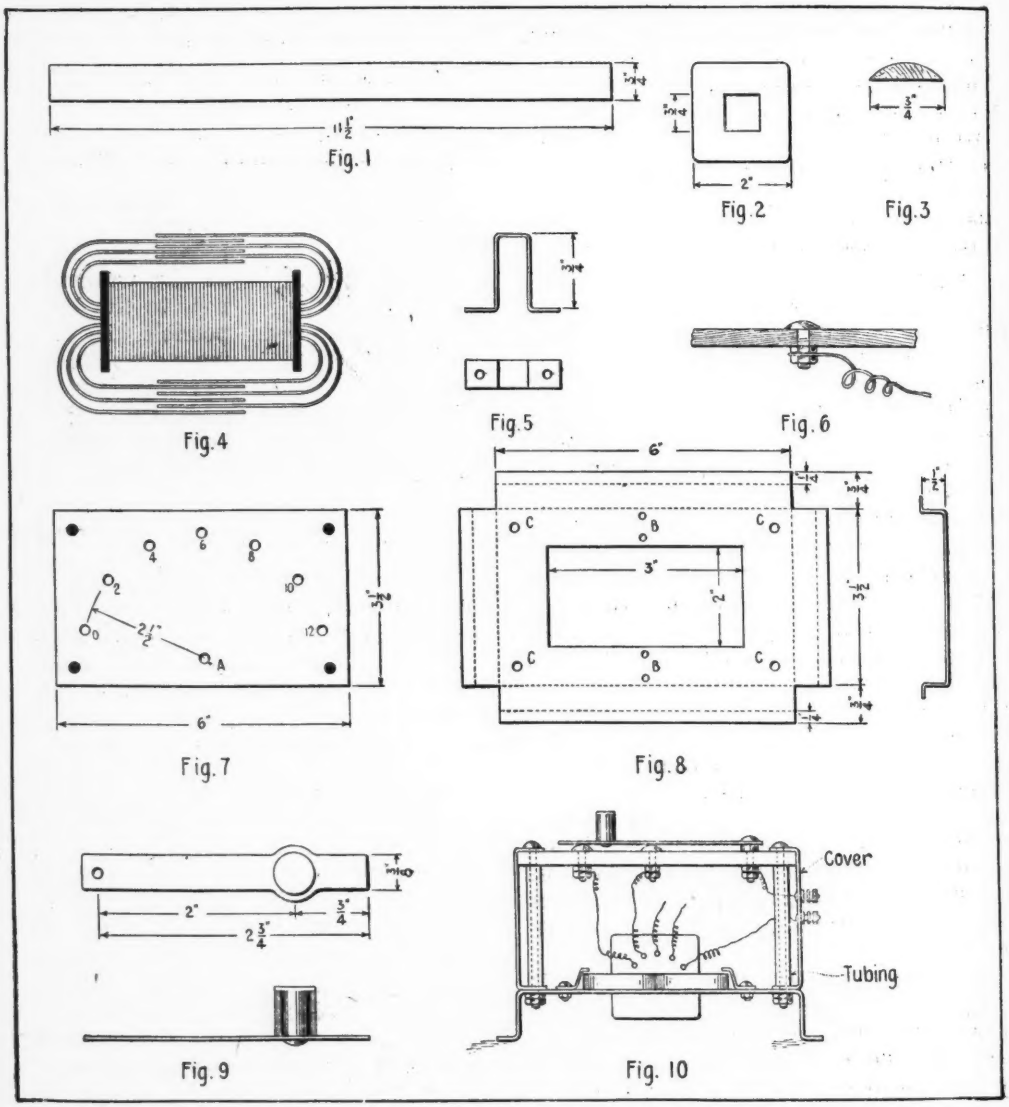
Wind on the core as evenly as possible about 312 turns, being sure to insulate layers with two layers of paraffin paper. Terminate this winding in the manner stated; namely, by soldering a 6 in. piece of No. 18 double cotton-covered wire to it; and don't forget the drop of solder. Drill a hole in the washer as close to the last layer as possible and bring out the heavy wire.

Should it be desired to have several different voltages, say 2, 4, 6, 8, 10 and 12, these can be had by tapping in on the secondary winding every 52 turns. To make this tap, scrape about ¼ in. of the insulation off and solder about 6 in. of No. 18 wire as described. Drill each hole in the washer as needed. Insulate each tap thoroughly and tag them on the outside of the washers, so that you will have no difficulty in wiring up the switch, to be described later.

Over the secondary winding, wrap, say, three layers of heavy insulating cloth, shellacking each layer in order to prevent it from loosening.

You are now ready for the primary or high tension winding which requires about 3 oz. of No. 34 gage single silk-covered copper wire. This winding is started from the opposite end from the secondary and will have the heavy No. 18 wire soldered to its end and the drop of solder to protect the connection. This heavy wire is put through a hole drilled down close to the insulation of the secondary coil, and the fine wire is wrapped on as evenly as possible. It has about 240 turns to the layer. Wrap on 12 layers for this coil, insulating each layer with a sheet of paraffin paper and terminating the coil with the heavy wire as previously described. Give this coil a coat of shellac and over this put several layers of insulating cloth, shellacking the layers together. This gives a very good finish to the entire coil and also serves as a mechanical protection.

The winding being completed, proceed with the finishing of the core to form the



Details of the laminations and the parts for the construction of a small transformer for reducing the alternating current to a low voltage for running toy trains and ringing bells

shell. First divide the core strips into two equal parts and bend back as shown in Fig. 4. Overlap each strip as far as possible, binding the ends with a piece of sheet iron bent in the form shown in Fig. 5 after having drilled through each end a ⅛-in. hole to facilitate mounting the completed coil and shell on a base.

For the switch, procure a piece of fiber about ⅛ in. thick, or a piece of wood ¼ in. thick (preferably fiber), of dimensions shown in Fig. 7. Drill ⅛ in. holes from 0 to 12.

Procure eight flat-headed brass screws, with washers and nuts—the kind used as binding posts on dry cells will do—and put one in each hole, attaching one of the wires for the different voltages to its respective binding post underneath the switch as shown in Fig. 6. The blade for the switch is made from a piece of strip brass about 1-16 in. thick and of the dimensions shown in Fig. 9. The handle is made of hard rubber, fiber or hardwood and a small rivet is used to hold it in place.

One of the ⅛-in. screws is passed through the small hole in the switchblade and down through the hole *A*, Fig. 6, in the switchboard and fastened on the other side with a spring washer and nut. The screw is then riveted over to prevent the nut from working off. The ⅛-in. holes drilled in the corners of the switchboard are for holding it in place as described later.

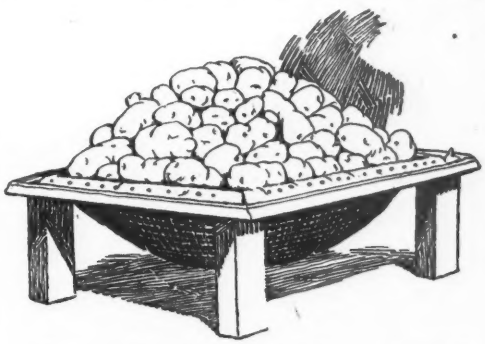
The transformer is now mounted on a sheet iron base as shown in Fig. 8.

As the diagram shows, it will require a piece of sheet iron 5 in. by 7½ in., cut and bent as shown. The center 3 in. by 2 in. is cut away to give good clearance for the coil. The ⅛-in. holes *B* are for the bolts that fasten the coil and shell, by means of the clamps to the base, and the holes *C* are for fastening the switchboard to the base. Small pieces of tubing about 2¾ in. long, slipped over the bolts, will act as dividers in keeping the switchboard up and away from the coil of the transformer. In Fig. 10 is shown the arrangement of the parts and how a cover can be placed over the entire transformer enclosing all parts except the switchboard. This cover should be at least ⅛ in. from any electrical part of the transformer.

The "line" wires or primary terminals can now be brought out of the case through porcelain bushings and connected with a light cord having an attachment plug on the end. There are only two binding posts on the low voltage circuit. One wire is run from the heavy wire at the starting point of the secondary circuit and the other wire is soldered to and leads from the ⅛-in. bolt holding the switchblade. These wires are fastened to binding posts on and insulated from the cover of the transformer. Be sure that all electric connections and binding posts are well insulated.

How to Make a Ventilating Potato Bin

TO make this bin four sticks of fire wood, or other similar material are required for supports, and a discarded picture frame and a gunny sack. The sack



Gunny sack supported on a frame mounted on posts for a simple ventilating potato bin

is taken apart to form one thickness and tacked to the frame. The texture of the material is sufficiently open to allow plenty of good ventilation. If no picture frame is at hand make a frame of 2 by 4-in. stock.—EDWARD R. SMITH.

Making a Paste for Coating Metal Surfaces with Silver

DISSOLVE pure silver, or a silver alloy, in cold nitric acid. If an alloy is used which does not contain lead, the acid may be warmed to hasten the process. Precipitate the silver with common salt until no more will separate from the solution. Make this precipitate into a paste by adding a little more salt, and cream of tartar. Apply this to the surface to be silvered with a cork and lacquer the article to prevent tarnishing.

A Direct-View Finder for Hand Cameras

IN photographing moving objects with the ordinary hand camera, the reflecting view finder is not always satisfactory. When the object being photographed is over 25 ft. away, it appears very small in the finder, making it very difficult to place correctly in the picture.

It was made of just a screw-eye and the camera post

Many excellent pictures may be made with this type of camera without using the reflecting view finder. The method used is illustrated in the picture. All such cameras are equipped with a movable leg for leveling the camera in making time exposures. A small screw-eye, such as commonly used for shade cords, should be inserted in the side of the camera box and on a line with the leveling leg with the screw-eye's face parallel to the back of the camera, to which the leveling leg is at right angles.

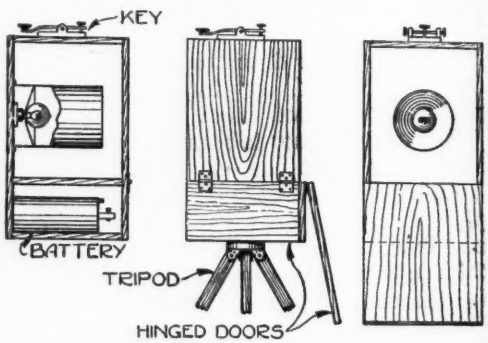
Use the screw-eye and leg as you would a gun sight, aiming at the object you wish to appear in the center of the picture. In the case of a moving object, you can follow it with the sights until you are ready to snap the shutter. After you have tried this method for a while you will neglect the regular finder, and seldom use it except for making portraits or views close to the camera.

One incidental advantage of the use of this method is that all pictures so made are taken from the eye level, and, especially on close views, appear more natural and true to life in the finished print. With the reflecting view finder all such views must be taken with the camera at the level of the waist. When the direct sighting method is used for taking close views, say a portrait at 6 ft., it is important that the camera be sighted at a point slightly above the waist of the subject, and the point aimed at will appear in the center of the finished picture.—JOHN F. MAHONEY.

A Blinker Telegraph Equipment for Boy Scout Work

SIGNALING by the flash of a light is a very practical method of communication over short distances at night. The small electric flash lamps run on dry batteries constitute a ready means of signaling in this manner and, with the use of a telegraph key in the line, a portable blinker set for Boy Scout work may be made as follows:

The box is made first with the dimensions shown, and provided with a separate compartment for holding two dry cells. A door is made for each of the two compartments; one opening on the front and the one for the dry cell compartment on the side. A large flash-light bulb is then mounted in a clean tin can with a small reflector placed behind it. The reflector may be of conical shape and formed from a piece of polished aluminum. The can is then mounted in the box and the light connected in series with an ordinary telegraph key and the batteries. The telegraph key is mounted on top of the box. A cheap camera tripod completes the equipment and, when used at half height, brings the outfit into a convenient position for the operator to manipulate the key while standing. The standard Morse or Continental code is used with this inexpensive and easily made telegraph equipment.



A small battery flash light placed in a box for sending signals with a telegraph key

A more powerful outfit, capable of transmitting signals several miles, can be made by using a storage battery in connection with a high candle-power light such as is used in the searchlights of automobiles.—RAYMOND FRANCIS YATES.